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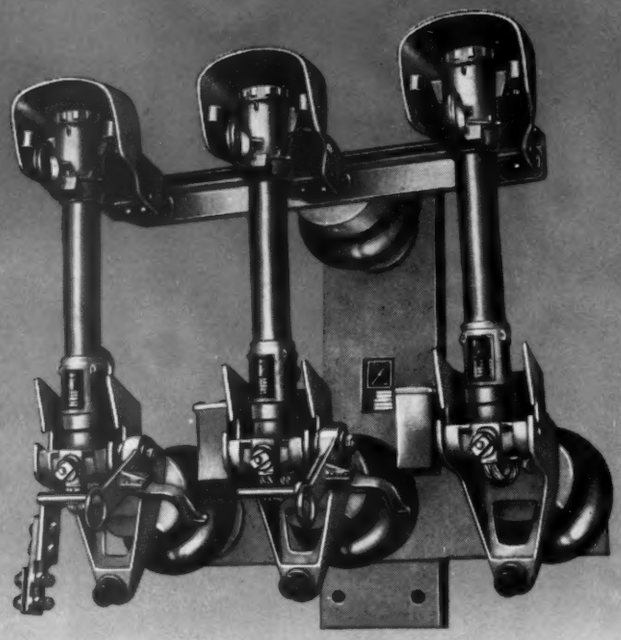
Electrical World

MAY 30, 1942

HOW

- Capacity of present facilities is being increased
- Service is being provided for urgent load
- Life of equipment is being prolonged
- Installations are being modified to conserve materials
- Adequate service is being contrived
- Inactive apparatus is being restored for service
- Scarce materials are being salvaged for re-use
- Maintenance is being facilitated
- Operations are being simplified
- Efficiency of operation is being improved
- Problems of depleted personnel are being met
- Utility plant is being protected and blacked out

A SYMPOSIUM OF SOLUTIONS TO WARTIME OPERATING PROBLEMS



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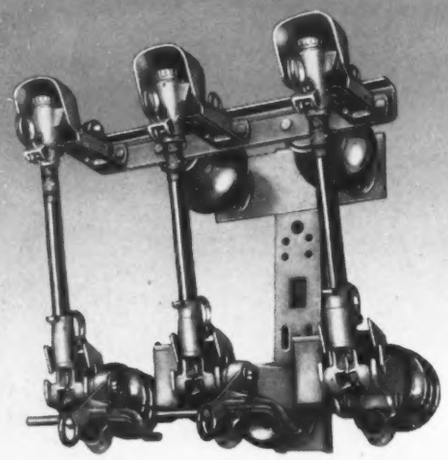
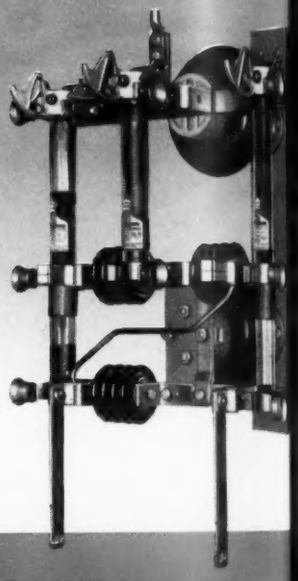
Below: Semafor MRSO 100-Ampere three-fuse Recloser, 5000 to 46,000 Volts.—Uses Universal S & C Fuse Links.



Below: S & C Loadgard Reclosing Liquid Fuses made in ampere ratings to 200, in voltage ratings up to 46,000.



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May 30, 1942

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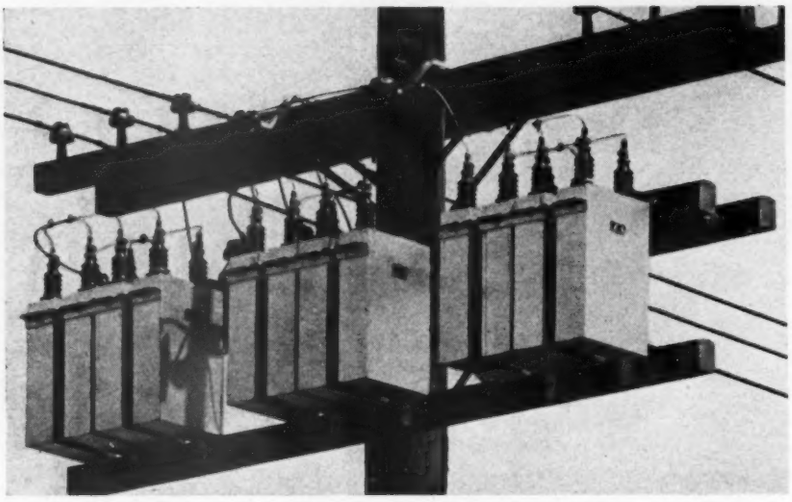

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American Resourcefulness

Our enemies once more are learning not to underestimate America. Maybe we were soft before Pearl Harbor, but we're getting tough awfully fast.

Other peoples can't understand that fundamentally Americans are resourceful. The country was founded by people who had little, and what they did have was of little use in this new world. They had to find new ways of doing things. They had to be able to meet new conditions quickly.

And constantly as the frontiers were pushed further and further back the pressure for getting things done with what was then and there available meant that the resourceful flourished.

During the years of plenty America lived well and to others may have appeared to be getting soft, but never was there eradicated from the character of the people that American ingenuity which made us survive in the beginning and kept us strong during our expansion.

Another characteristic of the American people is to build well of the best, using more rather than less. Sometimes this has been extremely wasteful, although it didn't appear so at the time because we had so much to do with. One would think that such a characteristic would leave a people helpless in a time of material shortage. But that is where the ingrained trait of ingenuity comes in.

If one were ever to doubt the ability of America to win over its enemies one would merely have to read the war-time experience in resourcefulness of any great American industry. Such an exposition is contained in this issue. The electric utilities of the United States, which supply the Number One raw material of war production—electric power—and which during the years of plenty built systems with but one thought in mind—how good can electric service be made—are now faced with material shortages. Maybe the tribes of Israel couldn't make bricks without straw, but the electric utilities of this country found they could make kilowatts without materials—at least with much fewer than before.

Perhaps these utilities could have said, as do other producers of raw materials, that they couldn't get along without

new equipment and stood their ground. They didn't because stamped into the spirit of the men who operate these utilities is the principle that, come what may, the service must be maintained. A mine may shut down or an aluminum plant may stop for a period of time and, aside from some loss in production which can be made up, nothing much happens. Electric service must not stop.

The following pages contain but half the material ELECTRICAL WORLD editors picked up in their visits to sixty or more companies. As will be seen, there is nothing big or startling in any of the items. The assembly, on the other hand, is big—and it represents only a part of what is going on every day.

It is with great pride that the editors of ELECTRICAL WORLD present this symposium of solutions to operating problems brought on by the war—pride in an industry that is living up to its traditions of service at a time when the greatest demands of history are being made on it and when it has the least with which to work, pride in the men of this industry who are living up to the best traditions of America. There is no such thing as can't; a way will be found, a way has been found.

To the sixty companies listed below that furnished the information for the items in this issue we express our thanks. There would have been a great many more names listed here if time had permitted our editors to visit them.

Edison Light & Power
York, Pennsylvania

Pennsylvania Edison
Altoona, Pennsylvania

Pennsylvania Electric
Johnstown, Pennsylvania

West Penn Power
Pittsburgh, Pennsylvania

Duquesne Light
Pittsburgh, Pennsylvania

Scranton Electric
Scranton, Pennsylvania

Luzerne County Gas & Electric
Kingston, Pennsylvania

Philadelphia Electric
Philadelphia, Pennsylvania

Jersey Central Power & Light
Asbury Park, New Jersey

Metropolitan Edison
Reading, Pennsylvania

Wisconsin Power & Light
Madison, Wisconsin

Pennsylvania Power & Light
Allentown, Pennsylvania

Water & Light Department
Morrisville, Vermont

Boston Edison
Boston, Massachusetts

Brockton Edison
Brockton, Massachusetts

Cambridge Electric Light
Cambridge, Massachusetts

Connecticut Light & Power
Hartford, Connecticut

Lynn Gas & Electric
Lynn, Massachusetts

United Electric Light
Springfield, Massachusetts

United Illuminating
New Haven, Connecticut

Western Massachusetts Companies
Greenfield, Massachusetts

Hartford Electric Light
Hartford, Connecticut

Worcester County Electric
Worcester, Massachusetts

Central Hudson Gas & Electric
Poughkeepsie, New York

Patchogue Electric Light
Patchogue, New York

New York Power & Light
Albany, New York

Public Service Electric & Gas
Newark, New Jersey

Consolidated Edison
New York, New York

Long Island Lighting
Mineola, New York

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Baltimore, Maryland

Pennsylvania Water & Power
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Carolina Power & Light
Raleigh, North Carolina

Duke Power
Charlotte, North Carolina

South Carolina Power
Charleston, South Carolina

Savannah Electric & Power
Savannah, Georgia

Georgia Power
Atlanta, Georgia

Alabama Power
Birmingham, Alabama

Idaho Power
Boise, Idaho

Northwestern Electric
Portland, Oregon

Eastern Oregon Light & Power
Baker, Oregon

Montana Power
Butte, Montana

Washington Water Power
Spokane, Washington

Puget Sound Power & Light
Seattle, Washington

Pacific Gas & Electric
San Francisco, California

Southern California Edison
Los Angeles, California

Coast Counties Gas & Electric
Santa Cruz, California

California Electric Power
Riverside, California

San Diego Gas & Electric
San Diego, California

Bureau of Power & Light
Los Angeles, California

Des Moines Electric Light
Des Moines, Iowa

Detroit Edison
Detroit, Michigan

Empire District Electric
Joplin, Missouri

Indianapolis Power & Light
Indianapolis, Indiana

Iowa Electric Light & Power
Cedar Rapids, Iowa

Kansas City Power & Light
Kansas City, Missouri

Nebraska Power
Omaha, Nebraska

Oklahoma Gas & Electric
Oklahoma City, Oklahoma

Public Service of Northern Illinois
Chicago, Illinois

Union Electric of Missouri
St. Louis, Missouri

Consumers Public Power District
Columbus, Nebraska

HOW electric utilities are solving operating problems arising out of the war . . . .

A symposium of 142 actual cases gathered from practices of 60 operating systems...

HOW capacity of present facilities is being increased

Add Condensing Water, Restore Old Unit

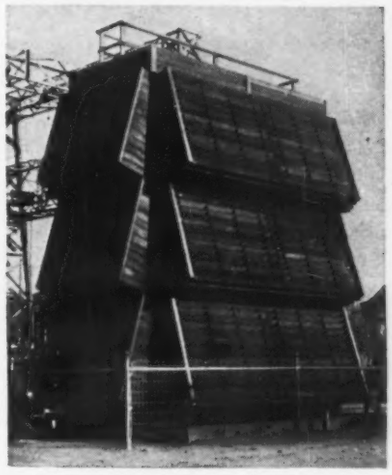
FLOOD-CONTROL and river dredging operations robbed a small Middle Atlantic utility plant of the previously ample supply of condensing water for summer operations. The new dam holds the flow more nearly constant, but the dredging (to avert low summer-flow stagnation within city limits) has lowered the level and reduced the gravity head which formerly assured the condensing requirements. Penstock changes are being made to accommodate two Pomona pumps which will circulate enough condensing water to permit restoring the 4,000-kva., 185-psi., 100 F. superheat turbo-generator to service. Priorities have been obtained and it is expected the machine will be running in the next three months.

This move will add about 6,500 kw. to local generation and relieve the interconnection supply of the same amount for delivery elsewhere. The 6,500 kw. has often been obtained from this 4,000-kva. rated machine in the past without distress on sustained peak operation. It is of 1916 vintage and has generous margin of mechanican strength and output. *ITEM 1*

Raising Cooling Capacity 100 Percent

IN AN EASTERN industrial community handling a large volume of war material production a 28,500-kva. power company substation serves diversified loads through transformers of the water-cooled type. Two home-made cooling towers formerly took care of the circulating water requirements, but to meet increasing demands on the substation the company installed in their place the tower shown. This doubled the cooling capacity of the old installation.

The tower was built of California redwood and is equipped with two Allis-Chalmers pumping units, each having a capacity of 130 g.p.m. against a total head of 160 ft. The motors are rated at 10 hp. each and are 220-volt, three-phase induction machines. Either will handle the water requirements. There is a concrete receiving basin under the tower and the main suction line is 4.5 in. in diameter, with 4-in. branching to the transformer banks. Make-up is obtained from city water, normal evaporation being about 1 percent and drift loss about 0.19 percent. The new pumps are self-priming, whereas the location of the older installation required priming with city water. The tower is



COOLING TOWER which replaced two home-made units in 24,000-kva. transformer installation

of the double-deck louver-louvered type. At 75 deg. F. wet bulb and incoming water at 101 deg. F., the cooling is to 83 deg. F. At 65 deg. F. wet bulb, incoming water at 93 deg. F. is cooled to 75 deg F. The tower proper was manufactured by the Marley Company, Kansas City, Mo. *ITEM 2*

Fans Cost One-tenth of Kva. Alternative

LOAD on a 60,000-kva., 66-kv. substation in Middle Atlantic territory is now predicted to pass the already exceeded rating of the transformers. The estimate of structural and equipment additions to increase the capacity approximately 50 percent so as to leave a safe margin above assured growth

was about $115,000. As much due to the difficulty in acquiring the equipment as to the desirability of avoiding any expenditure possible, the company decided to install a battery of fans to meet the peak load of the warmest weather in prospect, namely, August. The fan job is costing about $10,000.

Three fans will be installed per transformer (eighteen in all for the two banks of transformers). Each will deliver 5,000 cu.ft. of air per minute directed obliquely upward to the radiators and each will be driven by a 1-hp. motor. No automatic starting will be provided as this is an attended substation; the operator will start the fans as soon as the thermometers indicate the oil temperature has reached 70 C.

The direction, distribution and velocity of the air from the fans will be such as to scour away the film of stagnant air at the surface of the radiators, the principal source of resistance to dissipation of heat from the transformer losses. In this way the loading will be run up 25 percent (even in August) without exceeding the maximum coil and core temperatures permitted with self-circulation of oil. *ITEM 3*

Rerating Results in 18,200 Kw. Increase

DUE to the difficulty nowadays of buying new generating capacity, one of the largest Eastern systems has procured added capacity by rerating generators through the use of increased excitation and auto-transformers to compensate.

The rating of one turbine-generator unit has already been increased and work is under way to increase the rating of two other units by the operation of the generators at a higher voltage, together with the installation of auto-transformers.

At one generating station a 28,000-kva., three-phase, 13,600/15,000-volt auto-transformer has been installed and with it the rating of a turbine-generator was increased from 22,500 kw. and 25,000 kva., 0.9 power factor to 26,600 kw. and 28,000 kva., 0.95 power factor.

At another generating station two 57,400-kva., three-phase, 13,200/15,000-volt auto-transformers are being installed as the company will increase the ratings of two turbine-generators from 47,250 kw. and 52,500 kva. to 54,300 kw. and 57,160 kva., 0.95 power factor, a gain of 18,200 kw. from the three units.

Higher voltage was impressed on the alternator field. The field current thus increased, although the alternator voltage did not to the same degree because of saturation. The insulation of the field is the thermal factor limiting the amount of increase in field current.

To compensate for the field increase in I^2R losses it was necessary to reduce the heating contributed by the armature. This came about partly by the inherent possibility of reduction in load current because of the auto-transformer and partly because of the improvement in power factor resulting from extensive program of system capacitor installation.

In adopting this procedure the company appreciated that it was making some sacrifice in the stability of the machine against the system because of the power-factor change, and also incurring some increase in losses in the auto-transformer, generator core and generator field. *ITEM 4*

Expanded Coal Storage Capacity

INCREASED FACILITIES for handling and storing bituminous coal have been provided by an Eastern power company. The fuel oil capacity of the steam plant's tanks totals 380,000 bbl., and the previous coal storage capacity of the yards was about 150,000 tons. This is being expanded to a total of 250,000 tons, and the program involves the erection of a new tower of wood instead of steel (1) on the water front; several conveyors and feeders; two new junction towers; two new bunkers; the purchase of a bulldozer for distributing coal from the stocking-out pile, and laying of about 2,500 ft. of new railroad track to facilitate handling coal cars. Both oil and coal can be expeditiously handled by water and rail as available.

The flexibility of the new layout is shown in the diagram (not to scale) and following comparison with the previous set-up:

Present System

Coal from tower 9 direct to old bunker 11. Distribution from 11 to all boilers by larry.

Coal from tower 7 to old bunker 11 via towers 8, 6, 8 and 10. (Tower 8 has crusher.)

Coal to storage from towers 7 and 9 by dumping into cars at junctions 8 and 10.

Coal by rail to track hopper 12 and bucket conveyor to bunker 11.

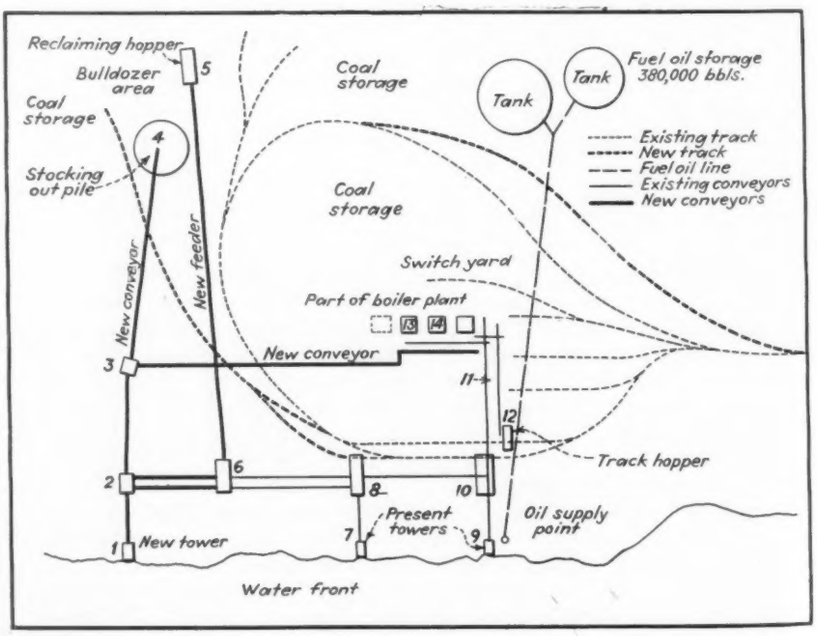
Coal from storage via cars, dumped at track hoppers 8 and 12.

Additional Facilities

Coal from tower 1 to stock-out pile 4 via junctions 2 and 3.

Coal to new bunkers 13 and 14, or to original bunker 11, via junctions 2 and 3.

Coal to old bunker 11 from new tower 1 via junctions 2, 6, 8 and 10.



IMPROVED coal-handling facilities

Coal from storage via reclaiming hopper 5 to new bunkers 13 and 14 and old bunker 11 via junctions 6, 2 and 3.

Coal from storage to old bunker 11 via towers 6, 8 and 10.

The new equipment includes a Carver tower (capacity 200 tons per hour), Mead-Morrison hoisting machinery, Stephens-Adamson conveyors, Pennsylvania crusher and General Electric motors and controls. The older towers 7 and 9 have an hourly capacity of 100 and 75 tons, respectively. *ITEM 5*

Discarding Preheater Raises Draft and Output

REMOVAL of a bleeder-type air-preheater from under the stoker helped a Middle Atlantic utility to make a gain in output without substantially affecting the station economy. It was realized that the air heater was causing considerable resistance to draft and that elimination of this loss would make a difference of not more than ½ percent in plant economy. The released capacity in fans and duct system made it possible to produce 120,000 lb. of steam per hour from the boiler, as against the 105,000 lb. obtained previously. *ITEM 6*

Hydro Plant Timed for Peak Service

ONE New England utility operates a 2,000-kw. hydro-electric plant, there being no storage capacity except at low water. At this stage the dam will store enough water for a two-hour run. Under ordinary conditions the capacity of this plant is insufficient to pay the cost of supervision. It has been normally operated with a float control on a run-of-river basis, the plant automatically cutting in whenever the water has been high enough to operate the float. Under war conditions, with numerous industries demanding energy for munitions and equipment production, it is increasingly important to utilize all available capacity to best advantage, especially under peak loads. An engineering study of this plant's operations was therefore made, and facilities provided to increase its usefulness under peak-load conditions.

A time switch was set up to operate in connection with the float control, a part-time attendant being stationed at the plant. The time switch is set to close the starting circuit at the time of the system "on peak" period. The master float control starts the unit when the water is 2 in. from spilling over the dam, and it stops the unit when the water level reaches a point 14 in. below the crest. The time switch is interlocked with the float switch equipment so that the unit starts if the water level is not more than 14 in. under the crest. Capacity is thus always available on peak, and at a small operating expense. The important peak comes in the evening, but the controls have been so arranged that with the operator in attendance the power is on hand for short peak use, regardless of the exact time of such demand. *ITEM 7*

Silver Plating Boosts Switch Capacity

SINCE, under the influence of arcing, oxides of silver tend to melt into globules of pure silver that are wiped back on contact surfaces by switch operation, contact resistance of silver-plated switch and breaker contacts actually tends to improve rather than worsen under severe conditions of load and operation. This is contrary to conditions that obtain with copper-to-copper contacts, since formation of oxides of copper of relatively high resistance is speeded by heating.

For these and similar reasons silver plating of switch contacts subject to severe duty is a noteworthy field means of increasing carrying capacity of switches subject to severe duty under present heavy war loads.

Of the several methods of silver plating switch contacts, the brush-plating method is being used extensively by one of the larger utilities in the Great Lakes area.

Procedure used by this company in plating contacts by this method is briefly described. Contacts are first cleaned and brightened with acid and washed with water. Next a cloth-covered "brush" or platen, connected to the positive terminal of a storage battery cell (the work is connected to the negative terminal), is dipped in sodium cyanide solution and rubbed slowly on the surface to be plated. Rubbing is continued for four or five minutes. Plating period of this length will deposit a 0.001-in. thick film of silver on a surface of 15 sq.in. Following the plating the contact surfaces are washed with water and the work is complete.

Care should be exercised in the amount of voltage applied to the work. Too much voltage tends to darken the deposit. It has been found that when a fully changed storage battery is used only one cell should be used.

The accompanying illustration shows contact surfaces of a disconnect switch being plated in the shop. In the case of the company where this photograph was taken all switchgear returned from service for reuse elsewhere on the system are brush plated.

CONTACTS of switches returned from the field for reclaiming are silver plated by brush method to increase carrying capacity

Contacts are also plated in the field where contact resistance measurements indicated deterioration of contact surfaces. Equipment used is made by W. A. Hesse & Company, Alameda, Calif. *ITEM 8*

More Fan Air More Generation

TWO steam turbo-generator units each of 30,000 kw. capacity or 37,500 kva. capacity at 80 percent power factor are in a key plant of a North Central utility. Very often the power factor is nearly unity and at those times it is desirable to carry 35,000 kw. load. Under present conditions difficulty is experienced in burning sufficient coal to produce enough steam to carry that load. The plant is provided with two steam generators burning powdered coal. Eastern Kentucky coal is used which contains approximately 13,000 B.t.u. per pound. Preliminary studies indicate that increased steam generation may be obtained by increasing the amount of air from the induced-draft fans.

The present induced-draft fans are equipped with Rossman Drive motors which provide a range of speed of the fan from 465 to 1,005 r.p.m. It is de-

sired to increase the speed beyond the present maximum.

It is proposed to use the two existing fan casings and their bearings and purchase two new shafts and new wheels capable of operating at higher speed than the old ones. The shafts will be somewhat longer than the old ones and arranged so that an additional and larger motor may be connected on the end of each opposite the one to which Rossman Drive motor is connected by means of a flexible coupling. The new motors will be the constant-speed induction type.

Plan of operation is to use the Rossman Drive motors for all loads up to about 30,000 kw. per generator. Then as the demand on the steam generator increases beyond this point, by means of electrical controls the new motor will be brought into action with a consequent increase in speed of the fan sufficient to furnish the required air for a load of 35,000 kw. per machine.

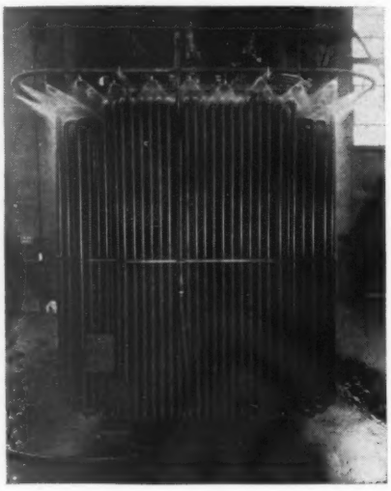
The total cost of the new parts and rearrangement of the old one required to increase the generating capacity of this plant approximately 10,000 kw. will not exceed $20,000.

It is expected that the increased capacity will be available by October, 1942. *ITEM 9*

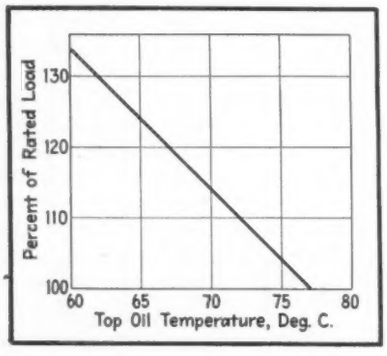
Water Spray Cooling of Power Transformers

SPRAY EQUIPMENT used by a Central States utility for auxiliary cooling of transformers consists of a tapped ring of 1¼-in. pipe fitted with angle nozzles supported by brackets from and near the top of the transformer in such relation to the surfaces of the transformer as to wet them thoroughly. It is important that the nozzles atomize the water stream so that the particles will hit the surface of the transformer as a mist, which will cling to it, thoroughly wetting without spattering. Spattering wastes water. No special drain basins are provided. Used water is allowed to drain the regular surface water basins.

It was found that 32 nozzles with an approximate water flow of 20 gal. per minute at 15 lb. pressure are most economical for cooling a 6,000-kva., three-phase transformer having an exterior surface design as shown.



WATER SPRAY cooling installed on 4,000-kva. transformer; tests were limited to transformers with radiators of type shown



CURVE guides turning on of transformer water spray. If the percent load vs. top oil point falls to the right of the line or if it is anticipated that it will fall there before the load peak is passed, turn on the spray. If the load is above 100 percent on a hot summer day or above 130 percent at freezing, it is to be expected that the spray will be needed

Water spray cooling has also been applied to 2,500- and 4,000-kva. transformers with uniformly satisfactory results. Test data for this 6,000-kva. transformer for 100, 158 and 202 percent continuous load is given in the following table:

Test Numbers	1	2	3
Percent load	100	158	202
Total losses in kw. at test temperatures	49	96.5	160.5
Water rate—gallons per minute	Self-cooled	20	20
Water temperature—ingoing	—	23	22
Ambient air temperature in shade	37	23	23
Ambient air temperature in sun	49	31	29
Top oil temperature	71.5	50.5	60.5
Average high-voltage winding temperature	80	73	88
Average low-voltage winding temperature	79	65	77

It is generally found necessary to increase capacity of the low-voltage bushings when increasing the capacity of transformers by water spray cooling. On transformers of larger sizes it is necessary to install non-magnetic adapters for the secondary bushings to prevent overheating of the tank cover as these parts are not cooled by the water spray.

Substation operators use the accompanying load-temperature curve to determine when the water spray should be turned on. The chart is based on a hot spot temperature of 100 C. and gradients between top oil and windings of an average transformer.

While the company has installed and tested spray cooling equipment only on transformers with cooling surfaces as shown, no reason is seen why spray cooling could not be applied to any self-cooled transformer; however, tests should be made to determine the winding temperature on transformers with other cooling surfaces. *ITEM 10*

Cooling Tower Frees Generating Capacity

BY INSTALLING a spray-type cooling tower of 4,000 g.p.m. capacity at its plant a Midwest utility company has found that operating efficiency of its existing generating equipment can be increased sufficiently to meet wartime load growth without reverting to the purchase of new capacity on an extended delivery schedule.

Studies revealed that installation of the cooling tower will reduce the temperature of water to turbine air coolers, turbine oil coolers, transformer coolers and house services 10–20 deg. below that otherwise obtainable from the river adjacent to the plant. The resulting increase in efficiency will release in the vicinity of 30,000 kw., it is estimated.

Under conditions existing at the plant water for house service purposes was obtained from the river. During low river stages in the summer months river water temperature frequently reaches 88 deg. Recirculation of water discharged from condensers under these conditions raises the temperature of river water used for turbine air coolers and other services to such high values that it is not possible to realize the full rating of generating equipment.

For example, under the worst conditions with one 35,000- and one 30,000-kw. units in operation the maximum load that can be carried is 53,000 kw.,

since recirculation of condenser water at this load raises river water temperature to 96 deg. Theoretically with machines operating at a full 75,000 kw., river water temperature would reach 105 deg. This condition has, however, never been allowed to obtain in practice. It is estimated that with a closed circulating system and a cooling tower supplying water to turbine air cooler and similar services it will be possible to carry a load of 85,000 kw. with a service water temperature of 85 deg. Thus it may be said that the cooling tower under the most extreme water conditions will release 32,000 kw. of otherwise unobtainable capacity.

Because of present difficulties in obtaining steel pipe the company plans to use transite pipe.

The cooling tower, as stated, is rated at 4,000 g.p.m. with a discharge head of 125 ft. It will require one 200-hp. pump and two four-bladed fans for 40 hp. each. Fans with plastic blades are proposed to meet the existing steel shortage. Tower structure will be of wood on concrete foundations and will cover an area 62 x 37 ft. and be 22 ft. high. Pipe required for the tower includes 720 ft. of 14 in., 164 ft. of 10 in., 264 ft. of 8 in., 40 ft. of 6 in. and 40 ft. of 4 in. *ITEM 11*

Method of Coal Handling Increases Yard Capacity

ANTICIPATING the need for larger coal supply on hand, a Southeastern power company increased the yard storage capacity at a steam plant 50 percent simply by changing the method of handling coal into and out of the yard.

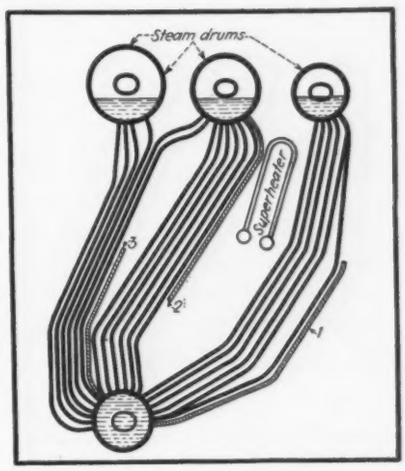
As designed, the yard contained three railroad tracks paralleling which the coal lay in four long piles. The coal was brought in and taken out in cars, unloaded and loaded by a locomotive crane. So operated, the yard had a capacity of 100,000 tons. Now, the capacity is 150,000 tons. The coal is unloaded from the boat or barge and dumped at the edge of the yard and is pushed into the storage area by a bulldozer tractor. Running over the coal in all directions, the tractor effectively compacts it, thus reducing the amount of contained air in the mass and lessening the danger of spontaneous fire. Although the tracks are covered up it will still be possible to remove coal from storage in the same manner as before, since the crane can start on any track and chew its way into the pile. *ITEM 12*

Boiler Baffles Improve Draft, Increase Output

STRUCTURAL conditions at a steam plant of a Southern power company ruled out any possibility of economical provision of induced draft. And yet the boilers were the limiting factor that held the plant to a maximum capacity of 70,000 kw. when turbines and generators were capable of considerably more.

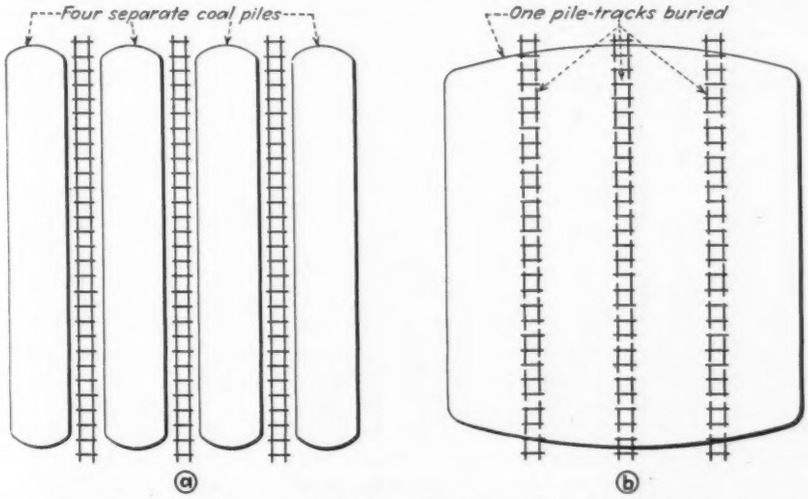
The plant now can handle a load of around 85,000 kw., an increase of over 20 percent. This result was obtained by changes in boiler baffling. As shown in the sketch, the boiler is of the Stirling type with three tube banks and superheater between first and second. The problem was to accelerate the speed of flow of combustion gases through the tube banks and at the same time permit adequate heat transfer to the water in the tubes. It was suggested that the so-called "filter" baffles be tried.

Filter baffles are baffles with holes made by leaving out more or less of the tiles or bricks, of which the baffle walls are built. The total amount of open space in any baffle wall is a function of the amount of gas desired to be by-passed through it and of the temperature, consequently the volume, of the gas. Thus the baffles nearer to the combustion space will have a larger total area of openings than with those farther away—an affair of calculation of gas dynamics too involved for a short article like this.



REVISION of boiler baffles raises plant capacity. "Filter" baffles in positions 2 and 3. Baffle 1 restored to solid condition after trial as a filter

The first trial was to make filter baffles of all three shown on the sketch. But this did not work well because a considerable proportion of the combustion gas did not reach the superheater tubes and the superheat dropped too low for satisfactory turbine performance. The first baffle, No. 1 on the sketch, was restored to its original state; the others left as filters. This arrangement worked beautifully. The boiler that previously could produce only 70,000 lb. of steam per hour now had an output of 90,000. And the net result with all boilers so improved was, as earlier stated, to raise a 70,000-kw. plant to an 85,000-kw. one, an increase of 20.14 percent. *ITEM 13*



YARD STORAGE increased by half. (a) Four piles = 100,000 tons. (b) One pile = 150,000 tons. Pile attacked from end of any track.

Raising Line Voltage Releases Station Capacity

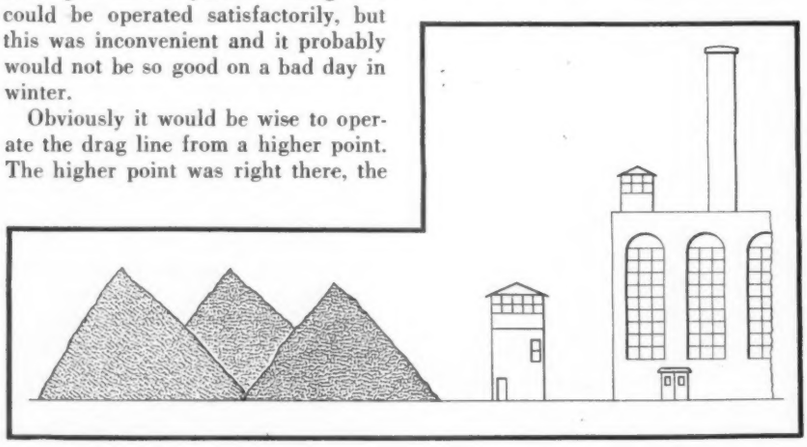
CHANGING to 100-kv. operation on a line built for that voltage but operated at 45 kv. has resulted in the release of approximately 13,000 kva. of generating capacity for load-carrying purposes on an Eastern system. Most of the 100 miles of line involved is double circuit. The change has not only raised the general level of system voltage by decreasing line drop but it has also increased the leading charging-current to such an extent as to offset the large magnetizing component previously required at the lower voltage operation.

At one plant with about 21,000 kva. of generating capacity it was usually possible to carry only 4,000 kw. of load because of system reactive requirements. At the higher voltage practically all of the 21,000 kva. can now be classed as kw. *ITEM 14*

More Coal Storage by Raising Handling Control Point

WITH the prospect that transportation might become a bottleneck, making difficult the obtaining of fuel supplies, a Southern power company started out to build up its stock of coal in yard storage. A lot more coal than was normally held could be put in, and was. And with the stocking-up there arose, coincidentally and literally, a difficulty. Coal is handled in and out of the yard with a drag line. As the coal piles rose higher the field of vision from the operating tower became more and more circumscribed, until finally the operator could not see over the tops of the nearest piles. With a signal man off on a pile in the yard the drag line could be operated satisfactorily, but this was inconvenient and it probably would not be so good on a bad day in winter.

Obviously it would be wise to operate the drag line from a higher point. The higher point was right there, the roof of the power house. Therefore, instead of building a new and higher operating tower, it was left as was and a cabin set on the power house roof. The motor controls in the tower were adapted for remote operation from the roof cabin and now the drag line operator can see what he is doing and the coal piles have an increased limit of height. *ITEM 15*



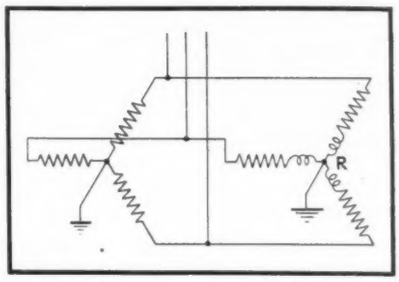
DRAGLINE CONTROL moved to power house roof allows greater coal storage

HOW service is being provided for urgent load

Paralleling Unmatched Transformers

AT A POINT on a Southern system a large increase in substation transformer capacity was urgently required. New transformers to replace or to add to the existing installation were impossible to obtain. The increase had to be made with available equipment. The existing installation was of a three-phase, 11/4-kw., 2,000-kva. transformer with a secondary impedance of 5.52 ohms. The available equipment consisted of three single-phase 11/4-kv., 1,000-kva. transformers whose secondary impedance was 3.2 ohms. To parallel these units with the one in place would be to allow heavy circulating currents between the new bank and the installed transformer unless a means was found to equalize the impedances.

The means was found, literally. A set of reactors had been removed from service some years earlier and were standing dusty and idle in stock. They were set up alongside the bank of single-phase transformers and connected in the center of the secondary Y as shown in the sketch. A little testing to find the proper tap points on the reactors and the job was done. And



REACTORS added to equalize transformer impedances

the substation capacity was raised from 2,000 to 5,000 kva. *ITEM 16*

Multi-Grounding Reclaims Equipment

MULTI-GROUNDING of primary neutrals and interconnection of lightning arrester ground wires with the secondary neutrals under present war conditions affords opportunities frequently overlooked, not only for improving system protection but for release of certain items of equipment no longer needed.

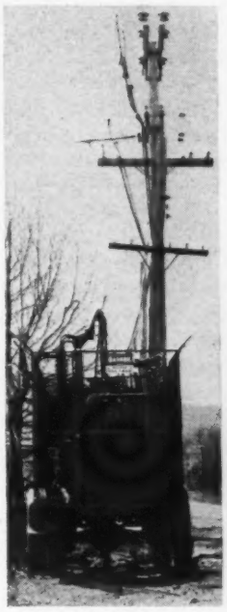
One utility company in the Middle West that has speeded up its program of multi-grounding and interconnection on its distribution system, as fill-in work for line crews between defense projects reports (1) the work is practically all labor, (2) considerable material is taken off the lines and returned to the storeroom and (3) the cost of transformers saved from lightning damage by virtue of improved protection will more than offset the cost of doing the work.

At each single-phase transformer station on the 11-kv. system of this company the transformer fuse on the hot leg of the system is put "inside" the lightning arrester. The ground

wire from the lightning arrester running down the pole is connected to the secondary neutral. The 2,300-volt lightning arrester on the neutral wire of the circuit at the station is removed and returned to the storeroom.

In the districts that have been interconnected the company reports that transformers lost due to lightning "can be counted on the fingers of one hand," or a very small percent of the losses prior to interconnection.

This company completed multigrounding and interconnecting stations on its 11-kv. system last spring and the program of work on the 4-kv. system, scheduled for completion over a period of years, has been resumed as previously planned. *ITEM 17*



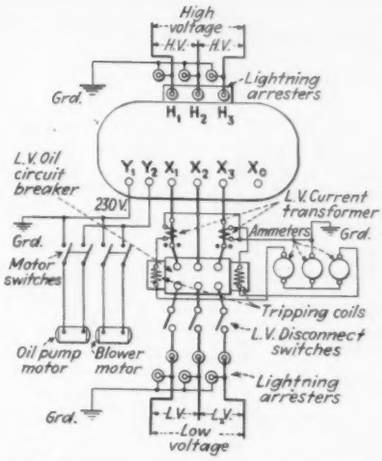
LIVE-LINE TAPS connect 500-kva. portable substation to 22 or 33 kv. (left)

KERITE CABLE HOODS of 25-kv. act as rain sheds on both bushing and line connections for either 22 or 33-kv. application. The rear end is jacked to take the load off the four rear-axle tires. Chains and padlocks across the front and rear wheels serve to prevent movement and discourage tire and wheel theft. Total equipment weight is 10,500 lb.

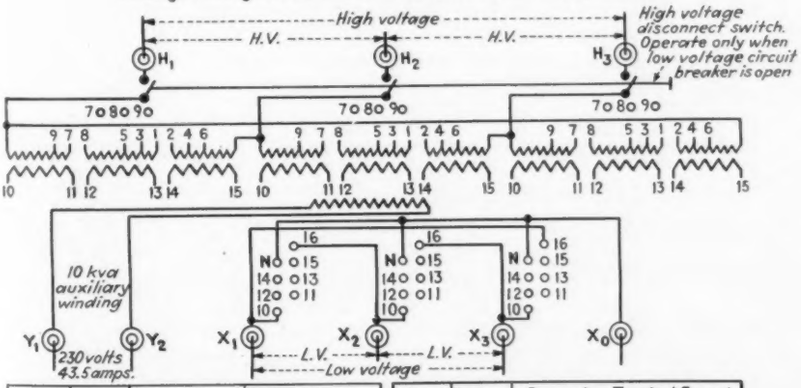
Flexible Portable Sub for Emergencies

ORIGINALLY mounted on an old truck, the portable substation of an Eastern utility is now carried on a truck designed for the purpose. The transformer is of 500 kva. with forced air and forced oil cooling and has three-phase voltages of 33/22-2.3/4 Y/4.6/6.9 kv. and a 240-volt secondary winding of 10-kva. rating for operation of the auxiliaries.

No pole-top switches are employed. The high-voltage oil disconnect switch is operated only when the low-voltage circuit breaker is open. The relays actuate the oil breaker on the secondary side; in addition there are disconnects. This substation has been used actively in transferring transformers from places where they are substantially underloaded or considerably overloaded to circuits where their capacities fit. *ITEM 18*



EXTERNAL CONNECTION diagram shows method of applying auxiliaries and protective equipment



High Voltage	Amperes	Terminal Board Connect on each phase	Tap Changer Position	Tap Changer Connects
34650		7 to 8	A	1 to 2
33825		7 to 8	B	2 to 3
33000		7 to 8	C	3 to 4
32175		7 to 8	D	4 to 5
31350		7 to 8	E	5 to 6
23650		8 to 9	A	1 to 2
22825		8 to 9	B	2 to 3
22000		8 to 9	C	3 to 4
21125		8 to 9	D	4 to 5
20350		8 to 9	E	5 to 6

Low Voltage	Amperes in Line	Connect on Terminal Board on each Phase		
2300Δ		15 to 16	10 to 12 to 14	11 to 13 to 15
4000Y		15 to N		
4600Δ		15 to 16	11 to 13 to 14	10 to 12
8000Y		15 to N		
6900Δ		15 to 16	13 to 14	11 to 12
12060Y		15 to N		

SIX secondary and ten primary voltages provided for on this 500-kva. portable unit supplied by Pennsylvania Transformer Company

Swapping Around Gains Worthwhile Kva.

SOME LOADS on distribution have, for one Middle Atlantic utility with outlying small-community divisions, moved up from 5- to the 7½-kva. bracket, creating an overstock of 5-kva. distribution transformers in those districts. Meanwhile many 7½- and 10-kva. units have been found in other districts to be loaded up to half or even less of their rated capacity, largely due to the impingement of war production on the respective industries. In normal times many new transformers would have been bought rather than apply crew labor to the interchange job.

Now, however, the shifts are being made with manifest gains in load-carrying ability.

The same company finds itself long

on transformers with 460/230-volt secondaries and short on the straight 230/115-volt secondaries. Meanwhile it was found that quite a few 230/115-volt transformer secondaries were serving loads that required only 230 volts. These transformers are being replaced out of the marginal supply of 460/230-volt units connected parallel for 230-volt delivery.

An industrial plant needed additional 4-kv. power. An auto-transformer could not be used on the 2.3-kv. supply because the customer's circuits were delta. No two-winding 4/23-kv. transformers were obtainable. So a 6.9/2.3-kv. bank was connected wye on the low side and delta on the high side to meet the need, although utilizing only two-thirds the capacity of the bank. The Y-neutral was not grounded; the protection is considered adequate. *ITEM 19*

Tapping Sources of Added Kva. Capacity

A COMPANY serving coal-mine territory has cultivated two ways of acquiring added kva. capacity for the system. One coal mine had two 2,500-kva. turbo-generators, but only one was being used. The power company built 1½ miles of 33-kv. line to the mine and installed a bank of transformers it had available so as to acquire the use of the idle generator.

Coal mine operations vary, particularly as mines are depleted. Advantage is taken of this to apply unused transformer capacity elsewhere. Three 200-kva. transformers were replaced by three 100-kva. and the large ones installed at a bulk oil plant for added pumping load (pipe line to tank cars) occasioned by the reversal of flow of crude and gasoline resulting from the Eastern shortage. A new portable substation was handy in effectuating the transfers.

Another worked-out mine could get along with a 50- and a 75-kva. transformer, so the three 200-kva. units there were transferred to an active mine where three 100-kva. transformers were insufficient. In normal times these shifts might have been deferred to save labor and to provide for resumption of load.

In some districts substations for mine service are relatively close together and occasional ones could be removed (as loads drop) if the priorities could be more readily obtained to apply copper to the requisite extensions of secondaries. *ITEM 20*

Relaying Saves Buying Breakers

INCREASING war and other loads made necessary a doubling of capacity in a distribution substation on a Southeastern system. Short-circuit current thus made possible was far above the interrupting capacity of the existing feeder breakers. To replace them with larger breakers would be difficult in these war times, not to mention the cost. The problem was solved by relaying that removed the heavy short-circuit duty from the feeder breakers and put it on another able to handle it.

The part of the diagram inclosed by dotted lines shows the addition to the substation. The maximum calculated three-phase short-circuit value from the two 7,500-kva. transformer banks is 130,000 kva. The four new feeders in the addition were equipped with 250,000-kva. breakers, ample in size. But the four feeders in the older part had breakers of only 95,000 kva., big enough for one transformer bank, but not for two. The relaying scheme that was devised to protect these breakers against heavy short-circuit current duty also relieves them of some duty at lower short-circuit values.

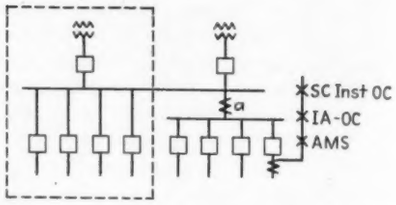
The scheme includes provision against three fault conditions:

1. On faults below 27,500 kva. the feeder breakers operate on their normal duty cycle, three reclosures at three, thirty and sixty seconds.

2. If the fault is between 27,500 and 75,000 kva. the instantaneous overcurrent relay on the feeder affected cuts out the three-second reclosure, but not the 30- and 60-second operations. Thus the feeder breaker will not reclose quickly on a fairly heavy fault.

3. If the fault is 75,000 kva. or more an instantaneous over-current relay at "a" cuts out tripping of all four feeder breakers and trips out one of the transformer bank breakers. When this breaker opens it closes an auxiliary switch which restores tripping to the four feeder breakers, allowing the faulted feeder to clear. Under this condition of heavy fault all automatic reclosing of the feeder breakers is cut out and stays out until the instantaneous over-current relay at "a" is reset manually.

Thus at a slight sacrifice in automatic reclosing an important saving is made. *ITEM 21*



MAKE OLD breakers serve in doubled substation

HOW life of equipment is being prolonged

Reversed Windings Prolong Generator Life

FAILURE of one of the three 37,500-kva. hydrogenerators of a Southeastern power company and a measure taken in its repair has probably prolonged the life of its two companion machines. This was the first generator failure in the fifteen years since the plant was put into operation. Investigation disclosed that the fault was caused by insulation breakdown from deterioration by corona. The generator windings are star connected, the central point grounded.

The corona effect was thus progressively greater outward from the center connection.

Arguing that there must be deterioration of insulation in all of the electrically exterior coils, even though only two were involved in the failure, it was decided to reverse the legs of the star, thus putting the insulation that for fifteen years had been subjected to high potential stress in position of stress greatly reduced. Since all of the generator coils had been provided originally with uniform insulation, this was entirely practical. It will not be possible to repeat this procedure because now the coils have

decreasing insulation value from the outer points of the star to its center.

To guard against similar failures of the two other generators, their internal connections are also being reversed. And it is hoped, if not confidently expected, that they will operate another fifteen years before they will break down from the effects of corona. *ITEM 22*

Paints Thwart Corrosion of Drums, Pumps, Pipes

PAINTS of proved performance are being used extensively by a Middle Atlantic utility to check the corrosion of metal surfaces of power plant equipment exposed to oxygen or acidulated waters. Boiler drums are painted on the inside with Apexior No. 1. Acid water action on pump bodies is minimized by application of Apexior No. 3; this is also applied to any steam line or water line subject to oxygen attack. It is flowed through small pipes, but applied to larger pipes with a rotary brush driven by flue-cleaner. In the case of cold water the corrosion is inhibited by means of Debricote paint applied to condenser water boxes, tube sheets, tube ends.

These measures have materially reduced the maintenance requirements for this equipment. *ITEM 23*

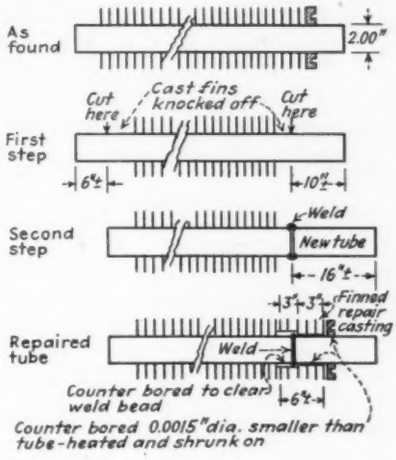
Hydro Turbine Valves Rebuilt

WHERE cavitation, suspended matter or other causes damage the needles or throat lining of hydro turbine valves, a Western Coast company now builds up the worn section by successively welding new metal in place. Then the needle and the lining are turned to size. The reconditioned equipment can hardly be distinguished from new. This picture shows two needle valves and throat liners that have been renovated in this manner. *ITEM 24*

Economizer Tube Life Doubled By Welding

LEAKAGE of economizer tubes at the header traceable to loosening of tubes due to corrosion is corrected by welding at the plant of a Central States utility. The repair method used makes it possible nearly to double the life of tubes costing in excess of $50 each for about $15. From 15-18 in. is cut from the ends of the used tube and an extension added at one end to restore the tube to original length. A special machined casting is added over the new portion of the tube and shrunk in place to restore sections of cast-iron cooling fins removed in adding the new section of tube.

In making the repair leaky tubes are "burned" out of the header, fin castings knocked off both ends for a



STEPS in the repair of economizer tubes by welding

distance of about 6 in. on one end and 12 in. on the other. Damaged ends of the tubes are cut off and trimmed. The end of the tube at which extension is to be added is scarfed and a sufficient length of new tube welded in place to restore it to original length. Attention is then directed to the fin casting that is to replace those removed.

These castings, shown in the accompanying illustration, are approximately 6 in. in length. This casting, which is to slip over the new tube section, is counterbored for a distance of about 3 in., to a diameter sufficient to clear the head of the tube weld. The remaining 3 in. is counter bored 0.0015 in. smaller in diameter than the outside of the tube (2 in.). Casting is then heated, slipped over the tube and allowed to shrink into place. The cast-end fitting of the tube is

SPECIAL FINNED castings used in the repair of economizer tubes by welding on new tube ends

similarly counter bored and shrunk into place.

A sufficient length of tube is allowed to project beyond the fin casting at each end of the tube to permit the tube to be rolled into the header.

The company has been using this type of repair on economizer tubes for about three years, repairing about 100 tubes, it is stated. *ITEM 25*

Wearing Pads Extend Fan Impeller Life

STEEL "WEARING" PLATES preformed to the proper contour are welded to the back of induced-draft fan blades at the plant of a Midwest power company to reinforce blade sections erroded by the action of fly ash. This repair is being used as a wartime measure to extend the life of fan blades beyond the present period of material shortages. It is estimated that normal life of fan impellers is doubled by use of these plates, since both the original blade thickness and that of the pad must be erroded away before replacement again becomes a problem.

INDUCED-DRAFT FAN BLADES eroded by fly ash are repaired by adding wearing pads; operator holds sample pad in place on back of blade

The original impeller blades of these fans, which handle 580,000 lb. of gas per hour at a speed of 900 r.p.m., are 24 in. long and are of ¼-in. mild steel. Erosion, as shown, occurs in a 4- to 5-in. section of the blade at the point where it connects with the center structural element of the impeller drum. Wearing pads, which are added to the 128 blades of each fan, are 6 in. long, 5 in. wide, ¼ in. thick and are cut and formed to the blade curvature by a local steel fabricator. Pads are added to the back of each blade around the entire circumference. In this way the impeller remains in balance after the repair job has been completed.

In the accompanying illustration one of the wearing pads is shown being held in place prior to welding it to the blade. *ITEM 26*

Metallizing Restores Packing Journal

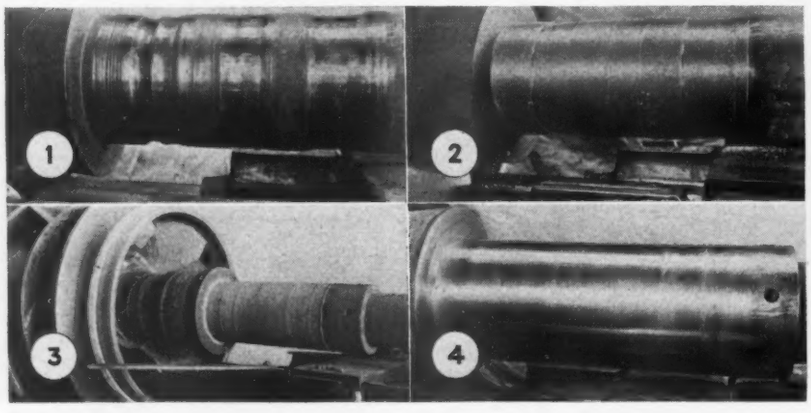
PURCHASE of new bronze packing journals for a large circulating water pump was avoided and usefulness of the old journals was substantially extended at a major power plant by skillful use of the modern spray metallizing technique. In this case the bronze sleeve journals, 8 in. in diameter, had been severely worn by ash and gravel in the circulating water, grooving them in several places to a diameter of 7¾ in. and at one point to a diameter of 7½ in.

In making the repair these grooves, having different diameters, were undercut uniformly to their individual minimum diameters, giving the sleeve a stepped appearance. Purpose of undercutting was to provide an even base for spraying. While the entire sleeve might have been turned to the smallest groove diameter, this was not done since it would have constituted waste of spray metal.

With undercutting completed surfaces to be sprayed were rough threaded on a lathe to improve the bearing between the parent and spray material.

To apply the spray metal uniformly, the entire pump rotor was swung in a lathe with the spray gun mounted on the tool carriage. In this way the journal diameter was built up to slightly more than 8 in., using Monel No. 1 wire. It was then turned to exact size and finished by polishing with emery cloth.

Accompanying illustrations show four steps in the repair. *ITEM 27*

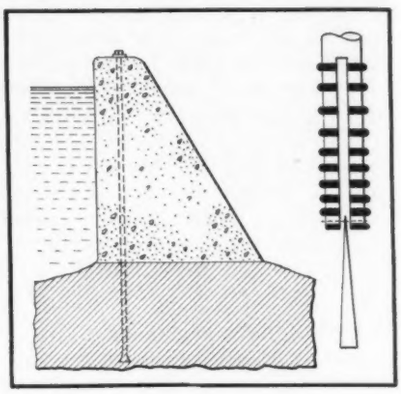


FOUR STAGES in the repair of work packing journal by metallizing (1) journal as found, (2) after undercutting preparatory to spray metallizing, (3) after spraying and (4) completed repair

Old Dam Anchored With Stay Bolts

CIRCULATING WATER for an important Southern steam power station is taken from the head pond of an abandoned small hydro plant. The 12-ft. high concrete dam is quite old and inspection of it revealed that under heavy flood conditions it might break or shift and condensing water for the steam plant be lost or, at best, considerably reduced. That was a chance, even though it was a remote one, that could not be taken at this time when continuity of operation of the steam plant was essential. It was decided to bolt the dam down.

Vertical holes on 8-ft. centers were drilled through the dam and down into the bed rock below for a distance of 6 ft. By the use of an expanding drill head the holes were made larger in diameter at the bottom. Around the bottom foot or so of the bolts—1½-in. steel rods, 18 ft. long—welded beads were applied and the ends slotted up a short distance as shown in the sketch. Hanging in the bottom of the slot by means of a cross wire was a wedge. When the bolt was put into the hole it was driven down over the wedge, expanding the bolt end in the enlarged bottom of the hole. Then a thin grout was poured in around the rod and allowed to set. Finally a plate was set over the end of the bolt and the nut tightened down on it. And confidence that the dam will hold is now complete. *ITEM 28*



STAY-BOLTS installed to hold old concrete dam

Blower Impeller Rebuilt Locally

NEW trapezoidal, sheet-steel blades to replace those badly "chewed up" in service were fabricated locally and

installed as shown on the impeller of a blower that supplies pulverized fuel to boilers at the major plant of a Midwest electric company. Note extent of errosion of blade shown beside the rebuilt impeller. Effective use of local shop facilities in this manner is vital in war-time to avoid unnecessary congestion of manufacturers' shop facilities. *ITEM 29*

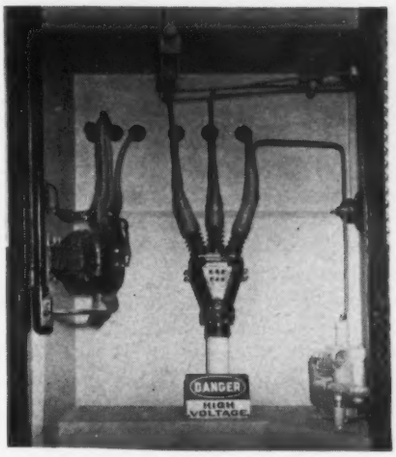
Wear Plates At Bends Extend Pipe Life

SECTIONS of coal feeder risers that have been eaten away by acid action and abrasion are repaired effectively at the plant of a Midwest utility company by welding reinforcing plates to the outside of the pipe at bends where wear is most serious. Many months of extra pipe life have been realized in this way at a time when steel conservation is essential. A typical repair in a section of piping feeding a coal pulverizer is shown. *ITEM 30*

Cut Flashlight Battery Purchases

IT USED TO BE that a meter man or other worker could go to the stock room of an Eastern utility and get replacements for his flashlight batteries by turning in the old batteries and saying that they were dead. But not now. Today the stock clerk sticks the old cells into the clips of a Weston battery tester and refuses replacements of all that show sustained voltages of 0.85 or more. If the circumstances of a man's work make it advisable, he may be given a spare cell or two to guard against failure of his light on the job.

Justifying this policy is a test of discarded batteries made on 456 cells turned in from various departments. All of the 456 cells showed sustained voltages of 0.85 or more on the battery tester, 33 of them registered between 0.85 and 1.0 volt, 156 showed between 1.0 and 1.2 volts and 267 went over 1.2 volts. Since the tester has been used purchases of flashlight batteries have declined about 40 percent—an estimated saving of around $30 a month. *ITEM 31*



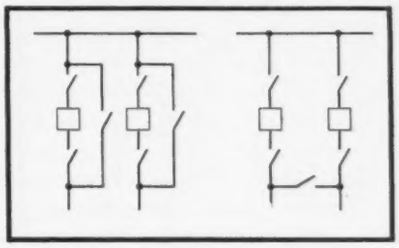
ONE FACE of a hydro-electric generator foundation is used to support leads and transformers

construction an opening in the back wall was bonded out and a block of 2.5-in. "Zellite" was installed, through which were inserted six porcelain tubes, the main and neutral leads being brought through these tubes to their respective terminal equipment. The design utilizes space economically and its protective features were provided at small expense. *ITEM 32*

Feeder Tie Saves a Disconnecting Switch

DESIGNS of past years including desirable features for which money and materials were then available may constitute a resource of available equipment that can be drawn upon to relieve scarcity today. This thought is inspired by a change in manner of connecting feeders to substation buses recently made by a Middle Atlantic power company.

Previously this company had used three disconnecting switches in each feeder position, one on each side of the oil circuit breaker and one in a by-pass by means of which the feeder could



BY-PASSES in pair of feeder positions require two disconnecting switches; tie between pair takes only one

HOW installations are being modified to conserve materials

Economical Compartment for Generator Leads

SIMPLICITY, safety, accessibility, economy and good appearance feature the design of a compartment housing the terminal equipment of an 1,875-kva., 6,900-volt, three-phase, 60-cycle GE hydro-electric generator in an Eastern utility station whose expansion was associated with the efficient use of an area of land bordering on a river and limited on one side by a stiff rise of ground.

This compartment housing, which is located in the basement of the enlarged power house quarters, utilizes an area 5 ft. square on one face of the generator foundation and is inclosed by a grill with locked door to prevent accidental contacts and to permit inspection from outside with the aid of a lamp controlled from the entrance.

Mounted at the left are the generator neutral current transformers for differential protection, while two potential transformers for power supply to the governor flyball head motor are located at the right. The main generator leads are brought to a pothead placed in the center of the compartment, from which a three-conductor, lead-covered cable runs to the generator bus on the main floor. During

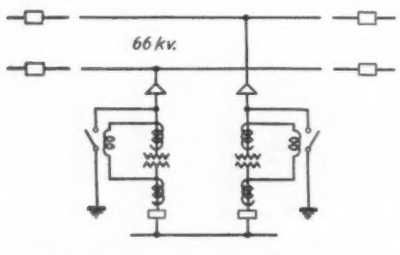
be kept energized while the breaker was isolated for maintenance or other work. The new arrangement, as shown in the accompanying diagram, substitutes for the by-pass a tie between adjacent feeders. Now when it is desired to work on a feeder breaker the tie is closed and both feeders are energized through one breaker. One disconnecting switch is saved out of two.

Obviously, to save one switch out of two, the ties can be made only between pairs of feeders. To put ties from one feeder to the next all along the line of several feeder positions is to save only one switch in the total required by the by-pass arrangement. The tie design has an advantage in that a feeder is never without oil circuit breaker protection, as is the case with the by-pass. On the other hand, it may be that the tie arrangement will be a limitation on flexibility if at certain times the load on the two feeders is too much for one feeder position to handle. *ITEM 33*

Fault-Grounding Lets Breakers Do Double-Duty

ADAPTATION of a scheme accredited to another company enables an Eastern utility to conserve circuit breaker and other protective equipment. In certain instances a fault within the winding of a 66-kv. transformer will not rise to a value sufficient to trip the breakers at either terminus of either line to which two banks of 10,000 kva. are tapped through air-break switches.

In order to insure clearing of the fault by the remote breakers some means was sought to increase the fault current to the point where tripping would be assured. This was accomplished by applying single-phase grounding switches actuated by the differential protection of the transformer on the faulted phase. *ITEM 34*

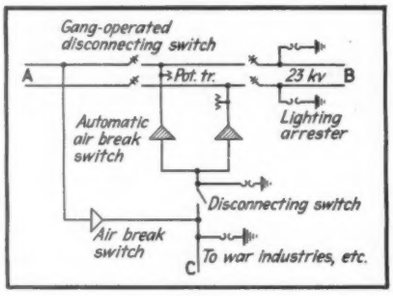


GROUNDING SWITCHES insures fault-current enough to trip breakers

Compact Tower Design for Switching War Loads

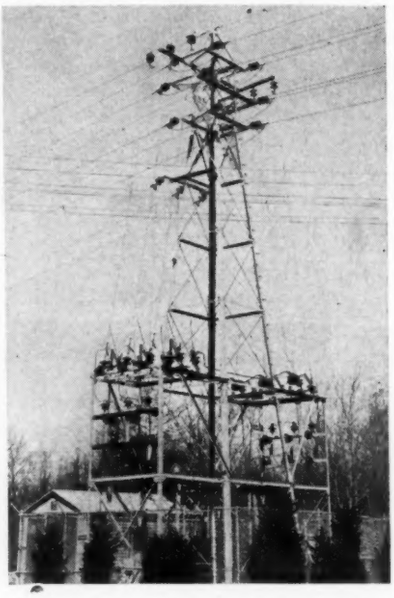
WITHIN a fenced-in area 24x30 ft. in plan a power company serving extensive war industry demands built a switching tower 50 ft. high to provide for controlling the energy supply to a neighboring load center from a 23-kv. tap circuit arranged to receive service from either or both of two main circuits A-B passing through the district. At the lower part of the tower a structure was built to carry automatic air-break switches by which the tap line can be thrown upon either circuit. This is 21x27x9 ft. high and a disconnecting switch is provided to cut the tap line clear of the automatics in case inspection or maintenance is required. An auxiliary branch tap from one of the main line circuits is installed near the tower to provide continuous service to the tap when the automatic switching equipment is being maintained. This is controlled by a manually operated air-break switch.

The main members of the tower are 6x6x3/8-in. angles and a relay house of the garage type (18x10 ft.) was



SINGLE-LINE DIAGRAM of 23-kv. connections showing auxiliary tap to maintain service to load center C during maintenance of automatic air-break switches

built to protect this equipment from the weather. The air-break switches are motor-operated. Normally the tap line to the industries is operated off one circuit of the main line, but if this fails, the relays function to switch the tap to the other circuit. Manual switching is utilized to return the tap to the original circuit. The installation includes lightning arrester equipment, gang-operated disconnects of the manually controlled type for the main line circuits and ample spacing between conductors for the operating conditions. No metering is done at the switching tower. The installation enables a flexible service to be given



VERTICAL STRUCTURES support through line and tap switching facilities in restricted area

with minimum danger of interruption to plants running 24 hours a day on essential work. *ITEM 35*

Substitute Another Size to Fit the Job

ENGINEERS take pride in their work and they like to feel that the job is right and looks right when they are finished with it. This is perfectly natural and is an evidence of the essential humanness of the engineer. But it often makes for an insistence on the exact letter of the specification which is neither necessary nor advisable today. To check against this disposition of the engineer an Eastern power company has an experienced man in the stores department whose job it is to examine all stores requisitions for construction material and to suggest the use of some material or equipment in stock in place of things specified and that would have to be purchased.

For instance, a requisition calls for a 600-amp., 15,000-volt oil circuit breaker. None of that size in stock, but there is one of 300 amp. Why was the 600-amp size ordered? Well, it's the regular size for that class of job. But the 300-amp. breaker will handle the load and it goes in.

Another bill specifies a device of catalogue number X-16-C, the latest

form of the basic X-16 design, of which there is an X-16-B in stock. The "C" model is a little more streamlined than the "b" and perhaps its performance is a shade better. But the "B" is on hand and a priority order is necessary to purchase the "C." the "B" model is installed.

Often a particular make is specified as, for instance, for a motor. The same size and type of motor is in stock, but it is not the specified make. The motor in stock goes out on the job. In these ways the stock clerk checking on the engineers justifies his special job. *ITEM 36*

Strength of Sisal Rope Below Manila

LARGELY DUE to the shortage of rope, particularly the cut-off of the manila hemp supply, an Eastern company is installing rigid supports for street lamps in places where the lamps had been lowered by rope for cleaning and replacement. The good manila rope is being saved for bull lines and line work. Sisal rope is being substituted for the less important functions, but, due to its lesser strength and life, the feeling is expressed that it should be identified in some way as a substitute. The rope now being purchased is oil-lubricated for better weather and water resistance, nevertheless it is recognized that it swells on being wet, it is less flexible and, because of shorter fiber, is considered more likely to break under sudden strain.

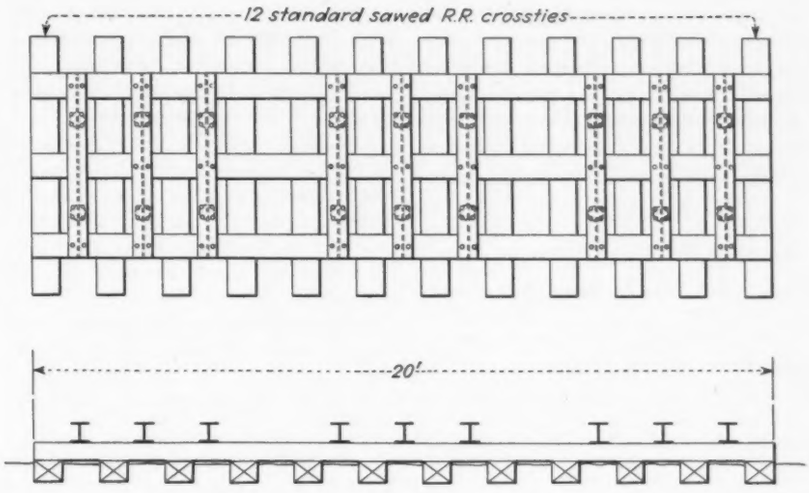
Thus it is feared that sisal woven into blasting mats would break through in a way that manila mats would not. Incidentally, this particular company uses 3x3-ft. mats to take the primary shock and protect the regular 8x10-ft. mats used in blasting pole holes. The small mats are woven from old rope.

Relative strengths of manila and sisal rope are indicated by the following table supplied by cordage companies as "guaranteed minimum breaking strengths" in pounds:

Diam.	Manila	Sisal	
In.	No. 1	No. 1	No. 2
¼	600	450	390
⅜	1,350	1,010	878
½	2,650	1,985	1,725
¾	5,400	4,050	3,510
1	9,000	6,750	5,850

Both grades of sisal are presumed to be Java sisal, the supply of which is now cut off. *ITEM 37*

Creosoted Timber Replaces Concrete



TIMBER FOUNDATION for transformer installation

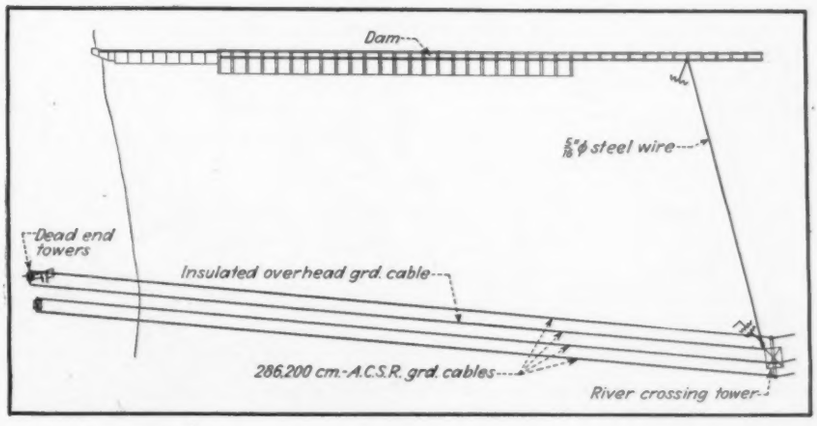
WITH WOOD easily obtainable, numerous utilities are turning to creosoted timber in place of concrete for transformer and other equipment foundations. The picture shows such a foundation recently built by a Middle Atlantic power company. Set in the ground on 21-in. centers are twelve standard sawed railroad crossties.

On the ties are three 6x8-in. timbers and across them, held by ½-in. lag screws 4½ in. long are nine 6x6-in., 25-lb. H-beams, 5 ft. long, on which a bank of three transformers rests. *ITEM 38*

Ground Wire Becomes Power Conductor

CONSIDERABLE saving of material and labor and additional security of service was obtained by using substitute materials and modifying an existing installation for an emergency power circuit at an Eastern hydro station.

Supply for this circuit was taken from a normal auxiliary power feeder and stepped up to 2,300 volts through an available distribution transformer. A single $\frac{5}{16}$-in. steel ground conductor from stock was used as the live conductor between the step-up transformer and a river crossing tower, with ground return. At this tower, which was to be illuminated, a 5-kva. distribution transformer was installed.

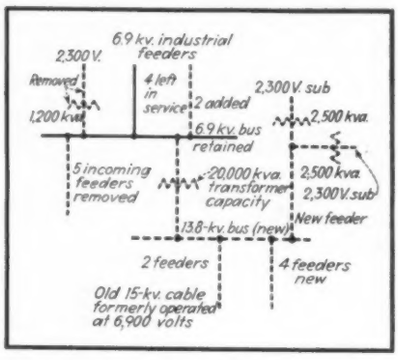


ONE OF FOUR ground wires is insulated and used as power conductor for lighting towers on both sides of river.

Four ground wires extend from this river crossing tower to the dead-end towers on the opposite shore, at which point additional emergency power was required. One of the four ground cables was insulated and used for the live conductor. The remaining three ground cables serve as return. Gaps are provided to protect the insulators and equipment in case of excessive lighting voltages. *ITEM 39*

Utilizing Existing Design in Substation Expansion

IN EXPANDING its service to war industries an Eastern utility found it necessary to develop major substation facilities to utilize 13.8-kv. feeders associated with the addition of generating capacity at this voltage at a major steam station. Earlier units had furnished 6.9-kv. energy, but the inauguration of tie line service was also associated with 13.8-kv. operation from terminal substations. It was important to preserve as much of the former 6.9-kv. substation facilities as feasible from the economic and engineering standpoints, and more than one example is available of this type of coordination.



SCHEMATIC DIAGRAM showing 6.9-kv. bus utilization after replacing incoming supply with 13.8-kv. feeders

Simplified single-line diagram shown for a representative substation indicates by solid lines the bus and feeder connections retained for 6.9-kv. operation after the introduction of the 13.8-kv. supply; by dash lines the 6.9-kv. equipment and feeders removed for service elsewhere, and by dotted lines the new equipment, buses and feeders provided for 13.8-kv. operation (and also two new 6.9-kv. feeders).

At this site 20,000 kva. in transformer capacity was added in an outdoor installation to tie the incoming 13.8-kv. and the 6.9-kv. facilities together; the new high bus was installed, with suitable control and auxiliary equipment, in cubicles, and a new 13.8-kv. feeder run to new substations distributing energy at 2,300 volts. An old 2,300-volt feeder stepped down from the 6.9-kv. bus was removed.

The higher voltage transmission to these smaller load centers (2,500-kva. substations) provided increased capacity and the existing 6.9-kv. bus and related facilities remained in use without incurring either the cost of new construction at this voltage level or risking the delays and consumption of valuable material had drastic changes been prescribed in the distributing side of the substation. *ITEM 40*

33-Kv. Line Has No Crossarms

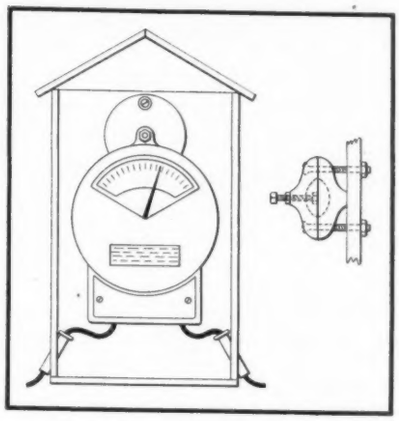
DESIGNED and erected to meet stringent clearance conditions in the alleys of a certain Illinois community, a 33-kv. line incorporates several features which render it noteworthy in the present period of material shortages. Completely without crossarms, this 1½-mile line with spans ranging from 150 to 200 ft. has its No. 3 three-strand copper conductors supported on line-post type insulators bolted directly to the pole.

Although this design was made to avoid the overhang of property which would result from the use of crossarms, the expected improvement in radio interference was taken into account. In straight line sections top and bottom conductors are placed on one side of the pole with the middle conductor opposed. On corners all three conductors are on the outside. The ground wire is fastened to the top of the structure and in some locations extended above the pole top on a bayonet. Insulator metal bases and through-bolts were bonded to the ground wire. *ITEM 41*

INSULATORS bolted to pole carry 33-kv. line

Insulates Demand Meter for Primary Connection

CLOSER AND CLOSER checking on all aspects of electric system operation is becoming necessary as the need for "doing more with what you have" bears down with increasing weight.



DROP CORD rosette insulates demand meter

Because of copper shortage, this is particularly true of distribution operations which have to be watched carefully as to loading of lines and transformers. An effective watcher is the thermal demand meter, sometimes connected in primary conductors and, so connected, required to be effectively insulated from ground.

But to house the meter in a small box for weather protection and at the same time insulate it adequately is rather a problem, a problem that has been solved quite ingeniously on a Southern system.

As shown in the drawing, the meter is hung on an insulated stud. The stud assembly consists of a pair of porcelain rosettes ordinarily used for ceiling drop cords. The rosettes are placed back to back with their screw holes in line and with the meter hanger stud through the center hole of one. The assembly is then screwed

—screw holes vertical—to the back wall of the housing. The meter is then hung on the stud. By this device the meter is solidly supported and is insulated by porcelain from the box—entirely adequate protection for the instrument used on 2,300-volt primary. *ITEM 42*

Frills Trimmed from Distribution Substations

DESIGNS of distribution substations can be simplified with gain in erection time, conservation of materials and reduction in maintenance. Oil switches can safely be reduced in number, according to the trend in an Eastern company; fuses can replace the breakers on the high-voltage side. Bypasses are found not as indispensable as was thought in less stringent days.

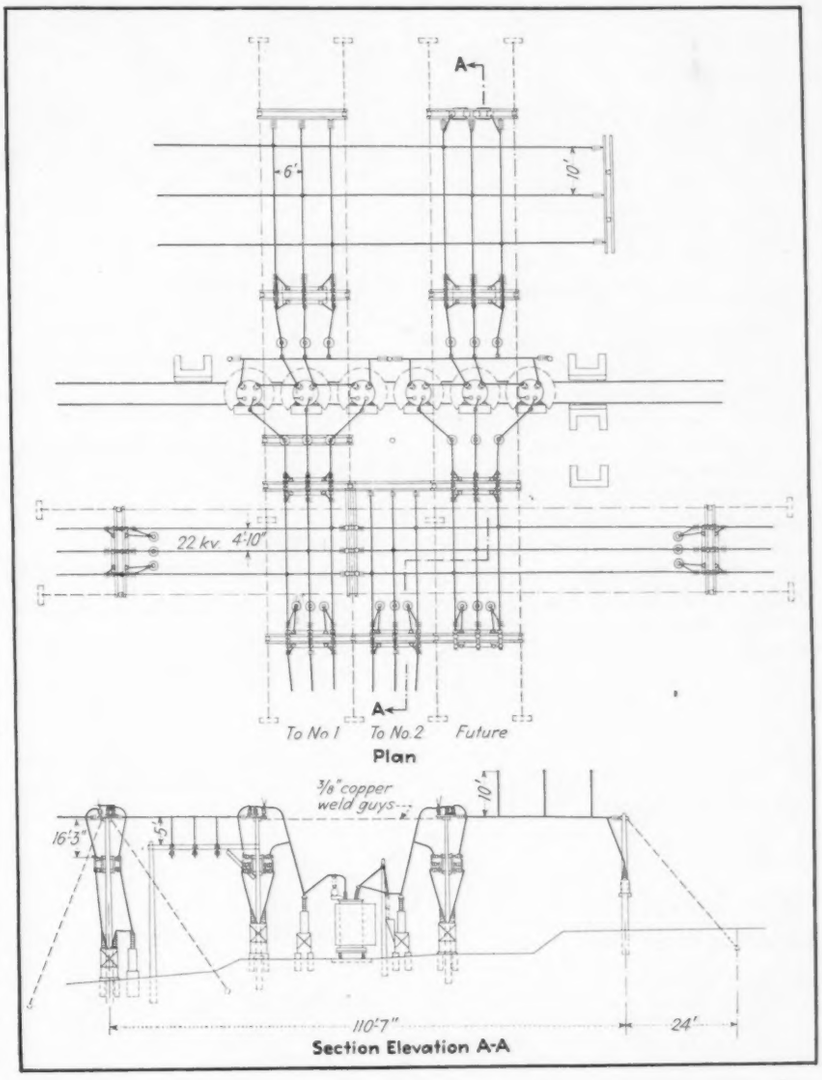
Air-break porcelain-housed disconnects on the secondary side suffice in many instances.

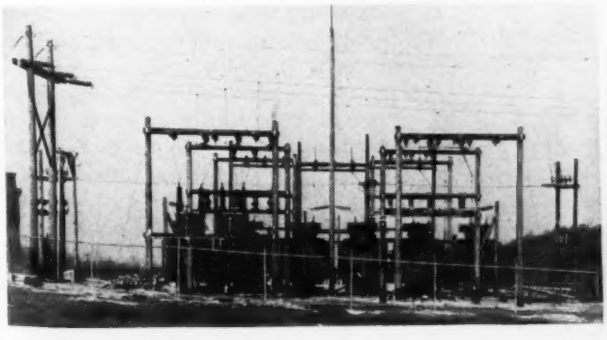
In one instance where all these measures were applied a 1,000-kva. substation took one-fifth of the space and cost one-fifth as much as a 600-kva. substation built according to prior conceptions of flexibility and safeguards.

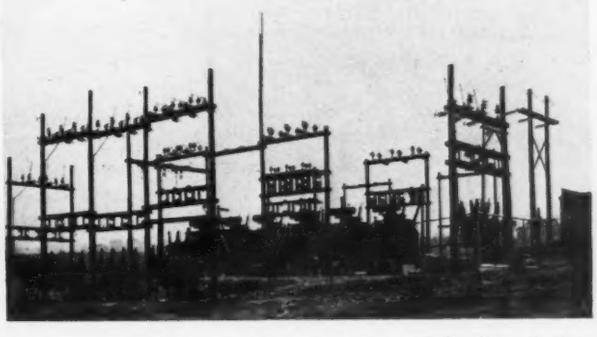
In lieu of two 2.3-kv., 24-kva. pole-top regulators (costing $2,200), three pairs of 7½-kva. capacitors (costing $800) were installed for series boost. The load is a conventional one and of about 50 amp. value. The capacitors give a 6-volt boost (on 120-volt base) at this load, about equal to the regulator correction. The G.E. gaps are used as the sole protection of the series capacitors with full confidence based on the successful performance when a 45-kv. line came down on the load side of a 5-kva. series capacitor installation on 2.3 kv.; no damage resulted. *ITEM 43*

Wood Replaces Steel Sans Special Hardware

PRACTICALLY all structural steel was eliminated in the wood design of a 15,000-kva., 66/22-kv., two-bank substation by an Eastern utility. No special hardware was required, everything taken from catalogues, including the Joslyn saddle washers for the 6x8-in. timbers which were used as cross-members. Guys were used to give lateral rigidity. This station has



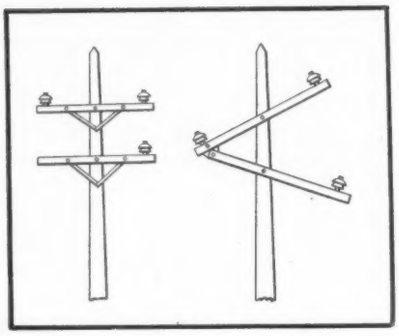




ALL-WOOD SUBSTATION has transformers on single straight-line track. A semi-circular track swings from each loading platform to the opposite one

been working for several months, but still awaits the delivery of certain items embracing the control, relays and panels. *ITEM 44*

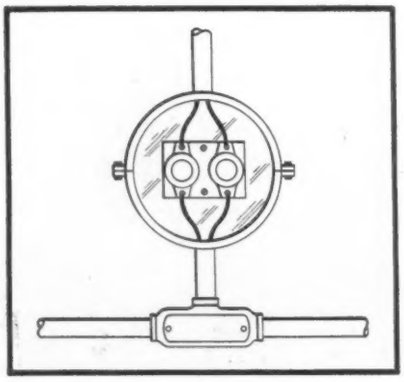
Saves Pole Line Hardware



CONSERVATION of materials, as well as of time and labor, results from the recently developed horizontal V-type of transmission line crossarm construction now coming into increased use under the pressure of wartime conditions. Self-braced, the design is rigid. In single-arm construction it eliminates the boring of four holes, two in each crossarm, and the setting of two lag screws in the pole and saves four galvanized steel braces with their screws and bolts. In double-arm construction the saving of materials and time is greater. At the point of the V the crossarms are held together by means of a bolted plate. The sketch is of 44-kv. construction on a Southern system. *ITEM 45*

Meter Receptacle Becomes Fuse Box

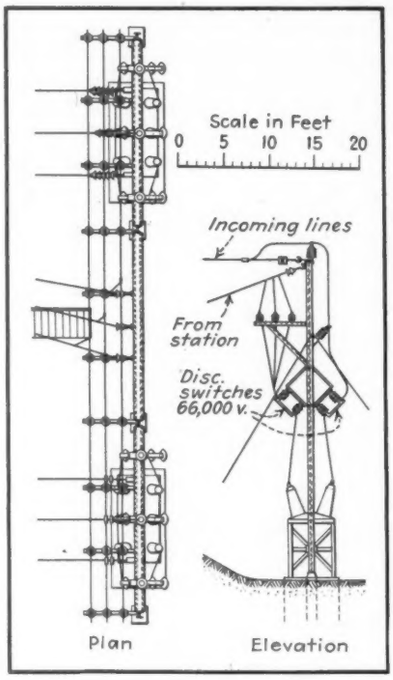
AN INSTANCE of the way in which the ingenuity of utility engineers is taking in stride the present difficulties in obtaining things that recently were easily available is shown by the accompanying sketch of potential transformer secondary fusing seen in a high-voltage substation in the South. The usual type of fuse box for such purpose was unobtainable. As a substitute an outdoor meter receptacle was used. The meter connection block was taken out of the receptacle and a double-plug fuse block put in its place. A flat glass cover was fixed on the receptacle with the meter holding ring and there was the potential transformer secondary fusing arrangement all complete. *ITEM 46*



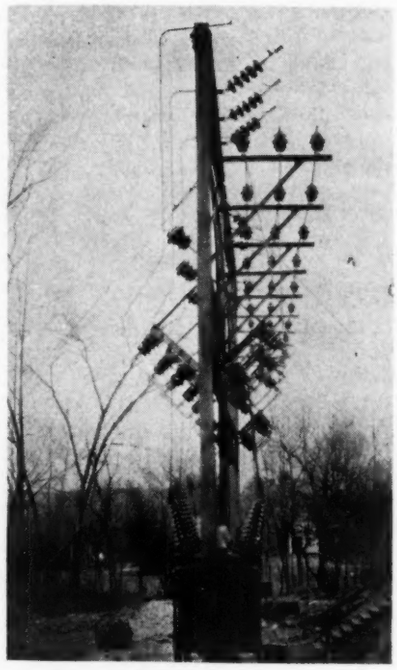
POTENTIAL transformer fuses in meter receptacle

Saving Steel in Substation Layout

TO OBTAIN an economical structure in an outlying substation by using available steel on a very limited scale an Eastern power company built the bus arbor illustrated outside the substation proper, carrying two incoming overhead 13.8-kv. lines, the bus and related disconnecting switches on a single bent made up of 8-in. I-beams and channels. The structure is about 35 ft. high x 64 ft. long and the buses are carried on insulators supported on steel brackets 6 ft. long. Each incoming overhead line is controlled by an oil circuit breaker mounted on a concrete base about at ground level. The 13.8-kv. buses are spaced 24 in. apart, and disconnecting switches designed for ultimate use at 66 kv. are located below on diagonal axes to facilitate operation by switch stick. The substation may be by-passed or supplied with energy from a third source of underground type not shown in this set-up. By guying the steel structure illustrated, adequate rigidity was obtained without the expense of installing a box type of arbor. *ITEM 47*



PLAN and elevation of bus and line terminal arbor



INCOMING lines and bus are supported on a single guyed bent

Working Over Old Poles

PRACTICE of a Northwestern utility has been to use cedar for stubbing native timber poles when the time comes that this is necessary. Now, the question arises: "How long will it be possible to get the necessary appropriate hardware, or even iron wire for wrapping, if that old-fashioned method were to be resorted to?"

So the company is taking steps now to meet such material shortages, in part at least. In the case of the poles, they are going where their lines cross the more arid regions and taking poles ready for stubbing, cutting them off and resetting them. It is a fact that such worked-over poles will not be good for more than three or four years, and that the practice is uneconomical from a purely cost standpoint. But, as against stubbing,

it does save a certain amount of hardware that can be used in wetter regions where a cut-down pole would be so short lived as to be altogether unfeasible. *ITEM 48*

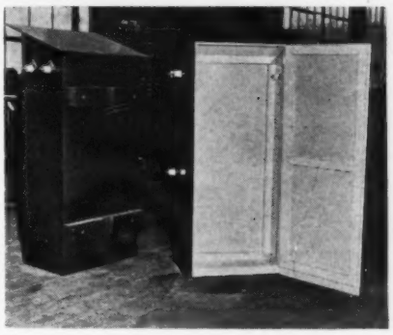
Emergency Cable Joint Reinforcement

IN ORDER to avoid the necessity of maintaining a large reserve stock of special lengths of submarine cable to provide alternate channel or river crossings in case of major trouble with regular lines a special joint reinforcement has been developed by a New England utility company to allow temporary restoration with the use of ordinary lead-covered cable jointed as required. The usual methods available for laying emergency cable for river crossings are likely to produce excessive bending and pulling strains on conventional joints, which results in sheath cracking at the wipes.

The reinforcement shown holds the joint section rigid and distributes bending stresses uniformly over a safe length of cable.

Tests made by lifting the assembly of cable, joint and reinforcement several times supported, first, only at the center of the joint, and, second, only at the ends, and, third, pulling the assembly over rough metal obstacles, indicated the reinforcement to be adequate for the service for which it is intended. *ITEM 49*

Wood Composition for Equipment Housings



WITH STEEL SHEET more and more difficult to obtain, utilities are turning to substitute materials for meter and other equipment housings. Here is a box made of "Tempered Masonite" by a Southern utility. This kind of composition wood is oil-impregnated and will stand the weather better than natural lumber or plywood. *ITEM 50*

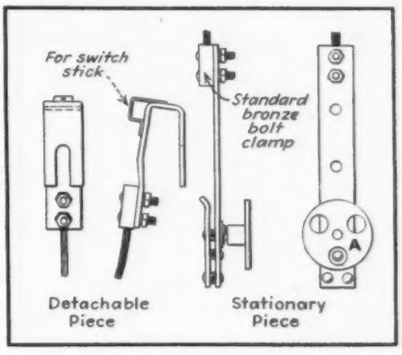
Enameled Substitute for Special Alloy

TO MEET the urgent requirements for practical substitutions for critical materials in steam plant maintenance, a West Coast utility is capitalizing on experimental studies that have been made with ordinary materials which have been treated with special enamel coatings. Satisfactory substitutes have been developed for the expensive special alloys usually required for many machine parts and valve trims operating at high temperature.

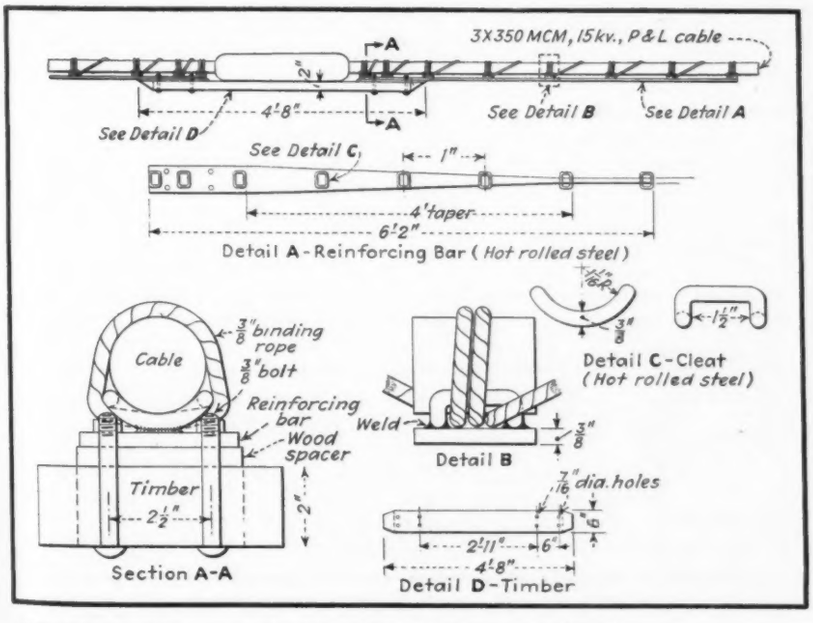
One such radical substitution which promises to give satisfactory operating performance is a 42-in. diameter salt water circulating pump runner made from cast iron instead of bronze. The runner is coated with a recently developed enamel which is resistant to both wear and corrosion. The enameling process includes baking on at a temperature of approximately 300 deg. F. The cost of the complete job is about 60 percent of that of a bronze runner.

Another application of this same type of enamel has been successful with valves and fittings exposed to acids and acid sludges at oil refinery steam plants. Experience has shown that cast-iron fittings treated with enamel have a longer life than the nickel chromium alloys originally used. *ITEM 51*

Substitute for Disconnecting Switch

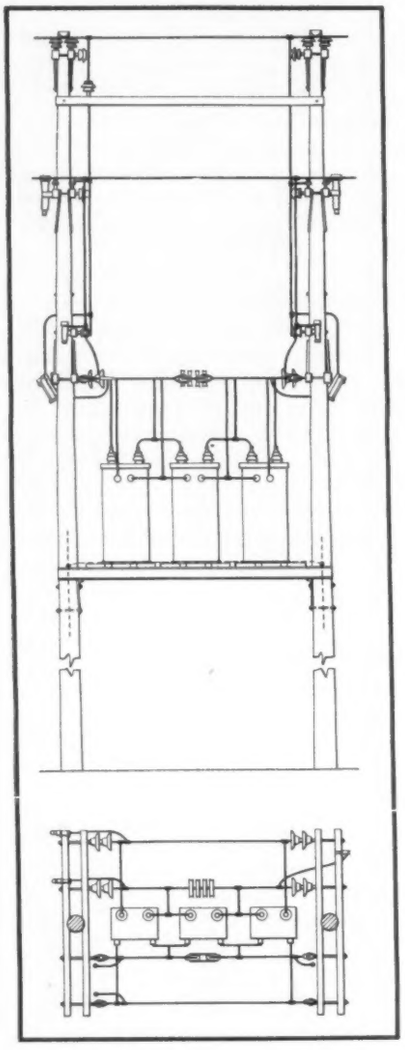


FOR USE on 4- and 11-kv. circuit breaker installations the engineers of a Middle Atlantic power company have devised a hot line disconnecting clamp as a substitute for the usual disconnecting switch. As is apparent from the drawing, the clamp can be made from short pieces of copper bar that otherwise have no more than junk value. The stationary piece is mounted on a suitable insulator which allows room at the back so that the disk nut A can be turned with a switch stick. The removable piece, B, handled by the switch stick by means of the rectangular loop at the top, is attached to the breaker lead and is hooked between the flat surfaces of the stationary piece. The disk nut is then turned up to make a tight contact with the detachable piece. *ITEM 52*



DETAILS of reinforcement of cable joints to be laid across channels

Economical Design for Tap-off Substation



SIMPLICITY in a pole type substation

BECAUSE of present difficulties in obtaining materials and equipments a South Atlantic power company set about to redesign its standard 13.2-kv. pole substation, with the result shown in the accompanying drawings. Except for a double-arm tie across the top, just below the primary arms, the only structural connection from pole to pole is the platform made of steel shapes on which the transformers stand.

Substations of this type usually have a couple of arms going across above the transformers on which fused cutouts are mounted and leads are trained. Instead the cutouts here are in the same positions as in an ordinary distribution transformer installation, two on one pole and the third on the other, easily accessible.

Primary and secondary bus arrangement across the top of the transformers is noteworthy. Each bus has only two crosses, one of them separated in the center by a strain insulator to allow connection to two phases.

The arrangement shown in the plan drawing is for delta connection, but star connection can readily be made with the same kind of bus arrangement. *ITEM 53*

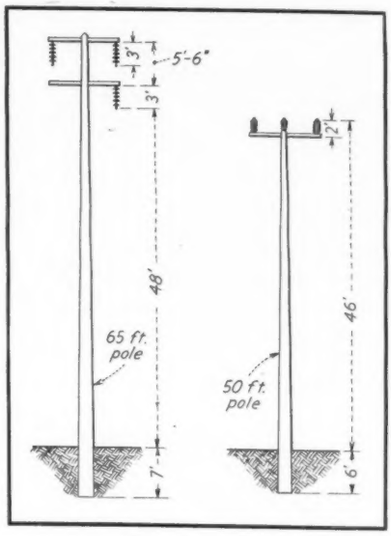
Substitutes Used in Line Construction

WHEN SCARCITY of longer poles threatened to delay the construction of a 66-kv. line to a new war load West Coast utility engineers modified standard specifications to permit the use of shorter poles and line post insulators. As shown in the accompanying illustration 15 ft. of pole height was saved.

In place of a 65-ft. pole equipped with two crossarms and three strings of conventional suspension insulators to give a triangular configuration, a 50-ft. pole with one crossarm and three line post insulators in horizontal configuration was used throughout the line.

The shorter poles were set 6 ft. in the ground instead of 7 ft., as would have been the case with the longer pole. Clearance was reduced from 48 to 46 ft.

Also, the company is using seven-strand steel guy wire as a substitute for copper conductor on tap lines serving agricultural load. Both practices save considerable quantities of critical materials. *ITEM 54*



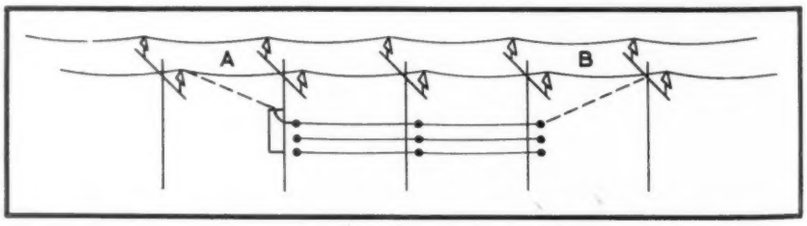
BY USING the construction on the right with 50-ft. poles and line post insulators a critical shortage of longer poles was met, saving 15 ft. of pole height as compared with the standard practice pictured at the left

Common Neutral Releases Copper

ON SINGLE-PHASE RUNS an appreciable amount of copper is being recaptured by an Eastern utility merely by running the neutral leg (Y-system) to the transformer secondary neutral at each end of a stretch of three-wire secondary. If the run is more than one span the primary neutral wire is removed and spliced for use elsewhere, if in good condition. *ITEM 55*

Guys Jumpered for Four-Wire Neutral

ONE EASTERN company uses guys as grounding points for the neutral of the four-wire system. These are installed without inserted insulators on new construction. When existing guys with insulators in them are to be used jumpers are installed across the insulator to effectuate the desired grounding instead of replacing the guy with new galvanized strand with no inserted insulators. *ITEM 56*

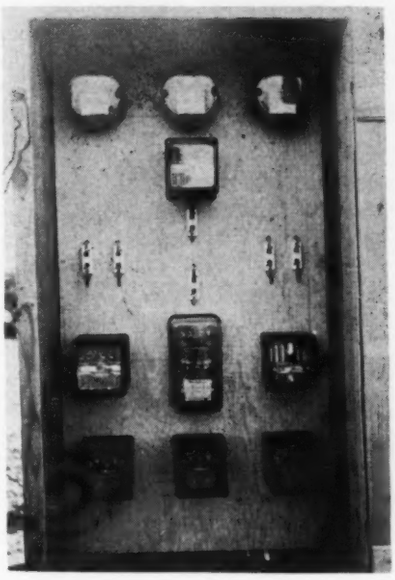


SECONDARY neutral functions for primary neutral also and saves copper. Spans A and B run to the transformer and intervening spans are reclaimed

Jury-Rigged Control for 110-Kv. Substation

TO COMPLETE an important inter-system tie one Southern utility had to build a large 110-kv. substation. Although ordered in plenty of time and, it was thought, with adequate priorities, equipment and materials for oil circuit breaker control failed to arrive. The substation had to go into service and that necessity was accepted as a challenge by the utility's engineers. The four-conductor stranded control cable had not come. The engineers found a quantity of nine-conductor solid telephone cable. They tied the wires in pairs to make a four conductor cable of it and had one wire left over for a spare.

The battery cable did not come. They strung up No. 4/0 weatherproof wire. The control assemblies did not appear. They scouted around over the system and brought together an assortment of relays and instruments which they wired up with No. 12 R.C. on plywood panels and housed them in wooden boxes. When the work of installing the heavy equipment was finished the jury-rigged control installation was ready to go. And it is still in operation, probably will remain for the duration. It has performed correctly six or seven times, hasn't had an incorrect operation and apparently is entirely adequate. *ITEM 57*



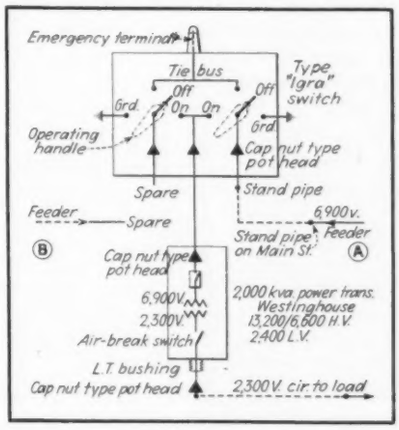
OLD RELAYS go back to work controlling a new substation

HOW adequate service is being contrived

Multi-Purpose Switching for Industrial Substation

IMPROVED substation design for service involving vitally important industrial plants and other essential consumers of energy on the system of an Eastern utility is illustrated in the accompanying single-line wiring diagram. The conditions involve provision for controlling energy supply over either or both of two feeders A and B (designed to form a loop circuit supplying two or more substations), maintaining continuity of service with either feeder out and the step-down transformer unit or bank supplied from the other feeder, bypassing the substation and supplying energy to it through an emergency terminal to which a Westinghouse portable substation can be connected, in case the regular transformer is out of service.

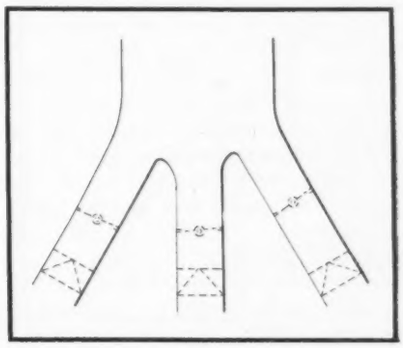
The handling of these circuits is effected by a type "IGRA" 15-kv., G & W, four-way, three-conductor, 400-amp., hand-operated switch with two rocker arms. The combinations available are: (1) Connection of cable or feeder A to the emergency terminal; (2) connection of cable B to the emergency terminal; (3) connection of cable A to the substation step-down transformer; (4) connection of cable B to the last-named; (5) connection of cable A to cable B through the tie bus or through the transformer terminal bus, and vice versa; (6) connection of either or both cables to ground. The transformer windings can be utilized in either series or multiple, to operate at either 13.8 or 6.9 kv. The transformer rating in two representative installations is 2,000 kva. and the layout insures service continuity under extreme conditions, with highly flexible switching in case maintenance is required. *ITEM 58*



ONE-LINE DIAGRAM of feeder, switching and transformer layout for flexible operation in handling vital loads

Sawdust Substitutes for Valve Repairs

THINGS GO BAD gradually, and then when they are bad enough they are fixed. But if the time of "bad enough" coincides with a period, as now, when it is difficult if not impossible to obtain what is required for fixing, that's unfortunate. Such was the fix a Middle Atlantic utility found itself in in respect of one of its hydro plants.



LEAKY hydro valves sealed with sawdust

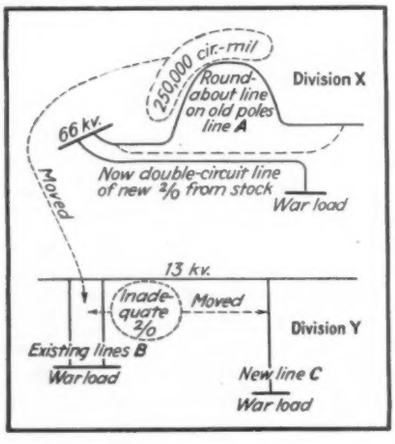
This is a high-head plant with a single penstock supplying water to three units. In the branch pipe to each unit are two valves, a Johnson and a butterfly, the latter on the head side. The valves were wearing and increasing leakage was coming through them, a condition that shortly would require a major repair job. That was foreseen. But it was not foreseen that rigorous materials control would be clamped down so

quickly and would prevent repair of the valves.

Then it became necessary to do some maintenance work in one of the turbines. The leakage through the valves made the work, if not actually dangerous, difficult and time-consuming. The head gate could be closed and the penstock drained, but that was a considerable job and the two other turbines would be shut down. Before doing that it would be advisable to try to plug the leaks in the valves. Cinders were tried first, force-pumped into the pipe above the valves. But the cinders soaked up and dropped to the bottom of the pipe and did not seal the valves. Then a few healthy slugs of sawdust were pumped in. The sawdust remained in suspension in the water, was carried quickly to the leakage points and sealed them off competently. And now, and for as long as there are no priorities on sawdust, turbine maintenance can be handled pretty well in this plant. *ITEM 59*

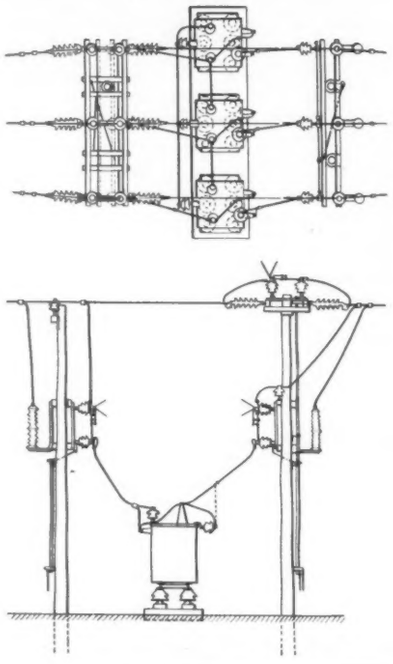
Copper for War Load Obtained by Shifting

ON ONE DIVISION of an Eastern utility a double-circuit 13-kv. line serving a war plant was No. 2/ copper; it needed to be No. 4/0. Meanwhile, a new No. 2/0 line has had to be built to serve another war plant. So the No. 2/0 was shifted over in the used condition. Meanwhile, the No. 4/0 wire requirement was met by transferring some 250,000 circ.mil wire from a roundabout line of 66-kv. which was shortened by building a more direct line on new structures to serve still a third war plant in another division. This stretch was double-circuited and new No. 2/0 copper from local stock is being used. A temporary hitch in the priorities arose only because of the additional hardware needed. The voltage drop with the No. 2/0 over the shorter run is no greater than with the 250,000 circ.mil for the less direct route. The distances are about equal. *ITEM 60*



TRANSFERRING WIRE from line A to line B and from line B to line C provides requisite conductivity for two enlarging war loads

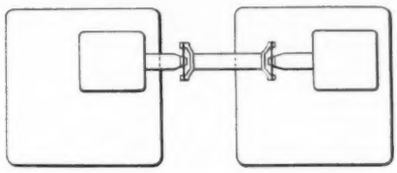
Booster Improves 44-Kv. Regulation



TO IMPROVE voltage on a 44-kv. radial line that serves a number of distantly spaced loads and to do so in the quickest and least expensive way a Middle Atlantic utility simply installed a fixed boost, as is often done on distribution circuits. The booster consists of a bank of standard 44-kv./2,400-v. transformers installed as shown in the drawing. Because both windings of the booster transformers are at line potential, the installation is entirely insulated, the transformers mounted on insulators as shown. The effective voltage rise accomplished is about 8 percent. By means of air-break switches the booster may be by-passed and isolated from the line. The booster is protected by lightning arresters on each side. *ITEM 61*

Paralleled Regulators for Double Capacity

LIKE TRANSFORMERS, regulators can be connected in parallel to increase capacity. But unlike transformers, the connection has to be mechanical as well as electrical. How



MECHANICAL connection between paralleled regulators

a Southern power company paired two regulators to get double capacity without loss of regulation range is shown in the accompanying sketch. The rotor drive motor and all control equipment were removed from one of the regulators. A shaft connection including two universal joints—automobile parts—was made between the gear boxes of the two units so that the motor on one would drive the rotors of both.

The electrical connections of two regulators in parallel offer large opportunities for error and it is advisable that they be checked and rechecked and then checked again to be sure they are right. The mechanical connection requires great care also, to assure that the two rotors are in identical positions. If the positions are not the same there will be circulating currents in the two rotors. This identity of rotor positions can be determined only by cut-and-try to reach a zero ammeter reading, or as close to it as possible, in each leg of the rotor circuit. *ITEM 62*

Thermal Trip Protects Two-Bank Sub

WHERE two banks of transformers are bussed together it is a matter of concern when one bank trips off and leaves the other to carry a load after approaching double rating. The risk of the overload going undetected at an outlying substation is too great to take in a period when capacity is at a premium.

An Eastern company is preparing to install on each bank a thermal trip which will allow an overload of duration sufficient to carry over normal

peaks of normal duration. Accelerated inspection will disclose the status if the trip has operated. Meanwhile, if the second bank should have tripped, the ensuing outage would have been reported; such temporary outages should be tolerated in the present emergencies.

These thermal trips are to be time-delayed bimetallic strip devices with low enough burden value to be connected into the metering transformer circuits; they will actuate the breaker trip coils when predetermined value of load has been exceeded for predetermined time according to the setting of the thermal relays.

Decision on this program was largely hastened by an episode in which a 2,900-kva. load was being carried by two 1,500-kva. banks of transformers. A surge tripped one bank because there had been no time-delay on the undervoltage release. The whole 2,900-kva. load was thrown on one 1,500-kva. for the peaks of two consecutive days before the condition was discovered. The transformers did not fail but, undoubtedly, their lives were shortened. *ITEM 63*

Power Banks Rated for Seasonal Limits

THAT NO TWO power transformers of different make, rating and environment can be given equal seasonal ratings is the conclusion of one Eastern power company after extensive tests. It is found that certain types and sizes in certain favorable locations can be rated up to 150 percent in winter and that others in summer and in unfavorable ventilation may have to be derated to the extent of 15 or 18 percent.

The amount of use under continuous loading was determined by test and determination also made for recurrent loading at the load factor encountered at the location of the particular unit.

Until these data were obtained and passed on to the operating department it had been customary to base the ratings on nameplate values, ignoring voltage, unbalance, ambient temperature and characteristics of local ventilation. Now the practice is to rate on amperes, thus avoiding the risks of coil overloading due to voltage unbalance.

Form in which the data of the test engineers are passed to the operating department is exemplified by the two accompanying tabulations, representing somewhat the extremes of overrating and derating which have resulted. Emergency rating for short durations allows a 10 deg. upping of both the top oil and assumed hot spot temperatures. For the normal load cycle the top oil limit is set at 80 C. In the case of the 6,000-kva. bank the spread of emergency rating is from 126 percent in July to 149 percent in January; for the 500-kva. bank it is from 108 to 135 percent. *ITEM 64*

A Substation

Bank No. 1 Type OISC Location Indoors 8° Diff. (Test)

Nameplate Kva. 500 Rated Current for tap used 217 Amperes

	Continuous Rating	Recurrent Rating	Emergency Rating
Load Factor	100%	62%	62%
Hot Spot Temp.	95° C.	105° C.	115° C.
Top Oil Temp.	75° C.	80° C.	90° C.

Based on H.S. Month	H.S. % Load	Oil % Load	Amp.	H.S. % Load	Oil % Load	Amp.	H.S. % Load	Oil % Load	Amp.
Jan.	115		250	125		271	135		293
Feb.	115		250	125		271	135		293
Mar.	109		237	120		260	129		280
April	102	104	222	113		245	123		267
May	94	88	191	106	101	219	116		252
June	89	76	165	101	91	198	112		243
July	85	63	137	98	82	178	108	108	234
August	88	69	150	99	85	185	109		236
Sept.	90	80	174	103	94	204	113		245
Oct.	99	99	215	111	111	241	121		262
Nov.	108		234	119		258	128		278
Dec.	114		248	124		269	134		291

B Substation

Bank No. 1 and 2 Type OISC 30 Location Outdoors

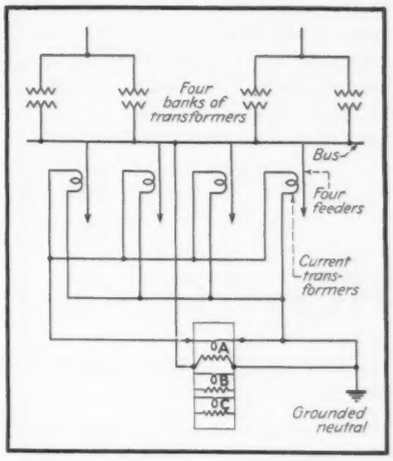
Nameplate Kva. 6000 Rated Current for tap used 800 Amperes

	Continuous Rating	Recurrent Rating	Emergency Rating
Load Factor	100%	68%	68%
Hot Spot Temp.	95° C.	105° C.	115° C.
Top Oil Temp.	75° C.		

Based on H.S. Month	H.S. % Load	Oil % Load	Amp.	H.S. % Load	Oil % Load	Amp.	H.S. % Load	Oil % Load	Amp.
Jan.	131		1048	140		1120	149		1192
Feb.	131		1048	140		1120	149		1192
Mar.	125		1000	134		1071	143		1143
April	119		952	129		1032	138		1103
May	112		896	123		985	132		1058
June	108		864	119	118	944	129		1031
July	105	104	832	116	114	912	126	131	1008
Aug.		105	840		115	920	127		1017
Sept.	109		872	120		960	130		1040
Oct.	117		936	127		1017	136		1089
Nov.	124		992	133		1063	143		1143
Dec.	129		1030	139		1112	148		1182

War Load Totalizing Saves Polyphase Meters

MANY of the war plant industrial loads have required successive banks of transformers and successive feeders into the plant, each originally



PARALLELED current transformers reduce number of meters for milti-service industrial load

separately metered. Economy in demand and reactive as well as kilowatt-hour metering is now being effected by one utility by totalizing on a single metering installation. This is readily effected where the current transformers have the same ratio merely by operating them in parallel as shown in the accompanying diagram for one phase of the polyphase service. *ITEM 65*

Capacitors Have to Keep Step with Load

SEVEN 15-kva. shunt capacitors had been applied as a series capacitor unit to improve the voltage and power factor of a 4.6-kv. circuit supplying some 35 resistance welders used in welding large chain links. Current fluctuates constantly from about 20 to 120 amp. over the 4,250 ft. of No. 40 and 250 ft. of No. 2 copper, but the voltage at the service is kept within 113–120 and 226–240 range by the capacitor bank. Approximately 80 percent of the 500-kva. load in the chain-making plant is welding.

Now the load is to be increased by about 90 kva. of additional welding. The Eastern utility reasons that if 105 kva. of capacitors per phase were just about right for 400 kva. of welding, then another 15 kva. should be added in parallel to each phase to maintain about the same conditions with 90 kva. of welding load increase. This is being done. Study has shown that no change in the automatic shunting for fault purposes will be necessary. Secondary wiring may, however, be enlarged by the chain manufacturer. *ITEM 66*

HOW inactive apparatus is being restored for service

Thrifty Substitutes and Salvage Methods Count

CROSSARMS are being fitted by a New England utility with through-bolts, braces and carriage bolts salvaged from removed plant. New crossarms will be drilled for wood pins, but there will be but two or four pins, depending on size and installed as received. Before sending arms up to linemen, ground forces will install such additional pins as may be required. A secondary crossarm will probably supersede the secondary metal rack, if the latter is later unavailable.

Cable services requiring replacement will probably be replaced by salvaged line wire. Transformers requiring replacement will probably be succeeded by reconditioned units. Core losses may be higher, but old bushings are being replaced with modern design, primary clearances increased, terminal boards removed and core and coil assembly cleaned of sludge and dirt. Several steps are being taken to conserve solder: (1) Use of mechanical connectors on primary and secondary joints to eliminate soldered split sleeves; (2) investigation of low tin content solder containing silver and bismuth as partial substitutes for tin; (3) use of reclaimed solder for lugs, terminals and conductor sweats.

Forty percent more waste paper is now brought to a central point and macerated before sale to destroy confidential records hitherto incinerated. The company uses 35 classes of materials in tin cans, including paints, floor waxes, oils and special products. Salvage will save about 4,000 such cans a year, formerly scrapped. "Pres-a-Ply" labels (Dennison Manufacturing Company) are being tested for can labeling, with good preliminary results, and hot water appears to have no injurious effect, so far as tests have gone.

Wire will be dipped in paint instead of galvanizing in certain cases, to give a satisfactory color. By substituting 800 lb. of wiping towels (mill ends) at $175 per month for 2,500 lb. of wiping rags at $600 in substation service, a large gain was thus made (Calloway Mills product is used). Street lighting equipment is reclaimed on a large scale, repairing luminaires, canopies, brackets and fittings at a central point. *ITEM 67*

RECLAMATION of street-lighting fixtures and material on utility system aids war program

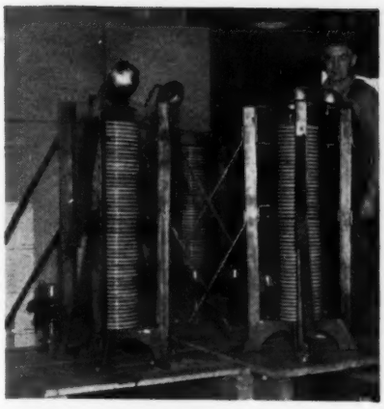
Oxide-Film Arresters Readied for Service

WAR-TIME SCARCITY of materials used in the manufacture of medium-voltage carborundum type lightning arresters for substation service has led several utility companies to recondition for standby service older oxide-film type arresters largely displaced by the development of the silicon-carbide arrester.

Shown herewith without their rain sheds are several such arresters for 13-kv. service which have been reconditioned in the shops of a Midwest utility company.

In reconditioning these arresters the cells were inspected visually, cleaned, tested, assembled and coated with Valspar-type clear varnish. Sphere gaps were buffed, polished and coated with clear lacquer. Wood members were sanded and varnished and metal skirts and fittings repaired.

After the units were reassembled, and before the arresters are returned to service, the points of arcing on the sphere gaps must be sanded to remove lacquer. This is of particular importance if characteristics of the gaps are to remain unaltered. Spac-



OXIDE FILM arresters reconditioned for lightning season as standby for modern units on restricted lists

ing of the gaps must also be closely checked before the arresters are installed. Reconditioned arresters are being held in readiness in the event existing arresters cannot be replaced on failure. *ITEM 68*

Generator of 1906 Put to Work as Condenser

COBWEBS were cleaned out of an obsolete 1906-vintage Stanley 250-kw. belt-driven generator, oil put in the bearings and then it was put to work as a 2,300-volt synchronous condenser to relieve the out-of-phase current duty of two 750-kva. waterwheel generators on a New England system.

It requires about 14 kw. to operate this condenser, which is not excessive considering the results obtained; it was run continuously for over four months last summer and kept the current on the two 750-kva. units down to the rated 180 amp. most of the time. Cost of the installation, including the 30-hp. starting motor, was less than $200, as compared with the $7,000 which would have been required to duplicate the results with new equipment.

Ordinarily, system power factor is considerably higher than 80 percent because loads are concentrated near the power house. Last summer, however, the water failed almost entirely and it was necessary to purchase in excess of 1,000 kw.; line losses and other factors created a low-voltage condition which lowered the system power factor and loaded up the generators with as high as 225 amp., though they were not carrying more than 50 percent of their rated load.

The old Stanley generator with exciter had not been operated for years because its associated waterwheel was worn out. It was disconnected from this wheel and belted to an available 30-hp., 2,300-volt motor for starting purposes.

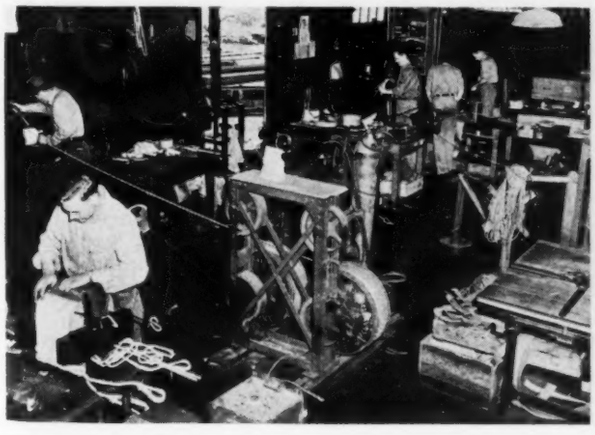
In planning this change-over, pulley sizes between the 30-hp. motor and generator were calculated to give a maximum speed of about 625 r.p.m., 600 being synchronous speed. This permitted synchronization by letting the machine drift down to synchronous speed after the driving motor was cut off. At first it was impossible to get more than 50 amp. out of the machine with the resistance cut out of the exciter and generator field rheostats. After experimenting with contacts, connections, brushes, etc., the diameter of the exciter pulley was finally cut down somewhat and this permitted 80-amp. output. Although 63 amp. is rated load for it, there is iron enough in the machine for three modern generators, so that the risk of overloading it is thought worth taking. Recently the pulleys have been replaced with a modern V-belt drive, which should lessen chances of belt breakage.

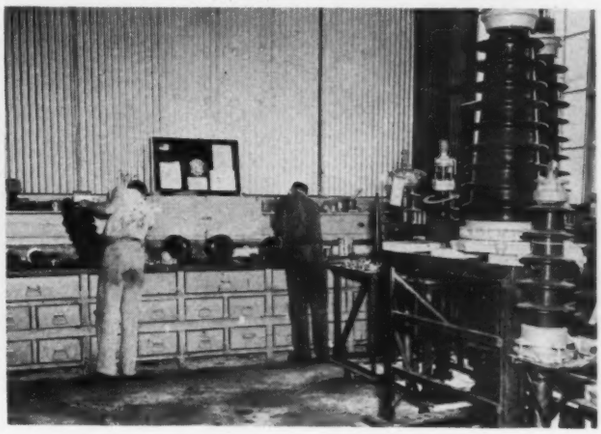
Before the installation was made it was necessary to keep the main generator on the line many hours in off-peak times for power-factor correction, with consequent loss of water and

Nibbler Nibbles Utility Shop Costs

WITH manufacturer's facilities devoted more and more to war effort, utilities are increasingly using their own shops for repair, rehabilitation and salvage operations. These three pictures were taken in the shop of a large Southern utility. The views of the coil winding and bushing repair departments below are of interest, but the most important is the top picture. This shows what the shop superintendent says is the most useful machine in the place, a nibbler. With its small chisel point vibrating at high speed, this machine is used to cut fiber insulation and thin metal sheets into any desired shape. The machine is handier and easier to use than

shears or saws and the work can be put through it faster. *ITEM 69*



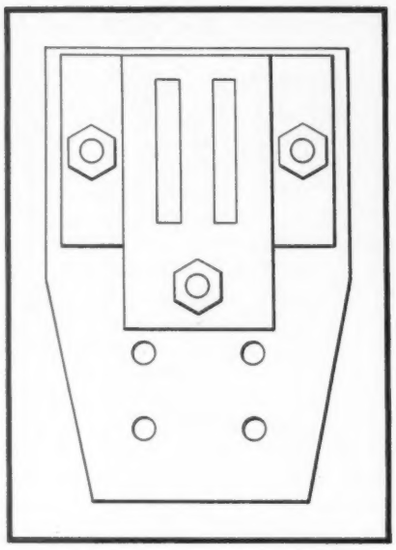


power to operate it. Now the generator is used only as needed.

Two 24-in. fans to force cooling air through the regular generators also proved to be a considerable help in warm weather. *ITEM 70*

Modernizing Apparatus Terminals

MECHANICAL CONNECTORS have pretty well superseded sweated-on lugs on modern electrical equipment. But there still remains in service and in useful stock a considerable quantity of apparatus that requires the use of a solder pot or blow torch to connect it up. Solder is something to be stingy with these days and it is more than ever a good idea to avoid, as much as possible, the use of lugs that have to be sweated on. One Southern power company is doing this and at the same time finding use for small pieces of copper bar that otherwise would be only junk. The accompanying drawing shows how a disconnecting switch terminal is thus modernized. The piece of bar, properly shaped and drilled, is set between the switch element and the insulator to which it is bolted. The bar may be slotted to fit any standard type of connector or it may be drilled to receive one or more U-bolts. *ITEM 71*



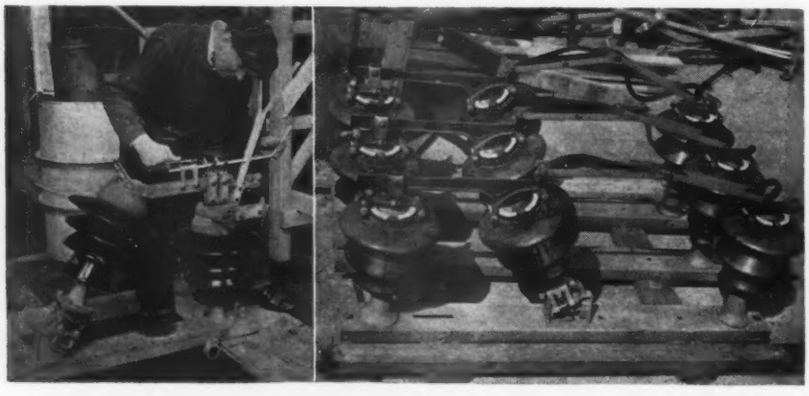
SCRAP COPPER used to adapt disconnecting switch for mechanical connectors

Air-Break Switches Made From Parts of Old Ones

CONVERSION of some obsolete air-break switches permitted scheduled delivery of power over a new 60-kv. transmission line in a West Coast utility division when manufacturers could not make delivery of the specified switches sufficiently early. Five 60-kv., 200-amp., two-insulator type air-break switches were constructed.

The problem was solved by converting some obsolete 66-kv., 200-amp., three-insulator type switches to the necessary two-insulator units. The reason for the required conversion was because the three-insulator switches call for the use of double wood-pole construction for mounting, whereas the two-insulator unit needs but a single pole.

In making the changes it was necessary to revamp the grasshopper switch mechanism. This was done by utilizing several parts from the scrap pile. Also the specifications required that the new switches be equipped with arcing horns. These were cast in the company foundry from available scrap metal. *ITEM 72*



FIVE 60-kv., 200-amp. air-break switches like this were assembled from parts of obsolete three-insulator 66-kv. switches of the type shown above

Additional Capacity at $3.75 per Kilowatt

IN THE MODERNIZATION of a Southern power station some years ago new boiler and generating equipment was installed. The old boilers, hand-fired and of lower pressure than the new, were kept as standby for the old turbo-generators, which, whenever they were used, ordinarily were supplied with steam through a reducing valve from the new boilers. The steaming capacity of the old boilers, hand-fired, was not sufficient to operate the old turbine at full capacity, but for the infrequent demands of standby it was adequate. Then came these present times, when every available resource of capacity is needed.

The old boilers—four Franklins rated 500 hp. at 175 lb. pressure—were equipped with industrial type screw stokers at a cost of $15,000, including associated improvements. The total firm capacity of the plant was raised 4,000 kw. With the new stokers in operation coal consumption was reduced 0.4 lb. per kw.-hr. as against hand firing. In 1941 the plant used 80,000 tons of coal. The annual average of the previous five years was 40,000 tons. Thus the plant output has more than doubled. Because of this large increase, economy comparison between hand and stoker firing of the old boilers is impractical. But an indication is had in the figures of cost of grate iron consumed—1.1 cents per ton of coal burned with hand firing and 0.29 cent with the new stoker firing. *ITEM 73*

Salvage Cable Used in Corrosive Soil

IN CERTAIN LOCATIONS where corrosion is troublesome it may be necessary to use a lead covering over bare copper to protect grounding conductors. It is sometimes possible to make use of old cables for this purpose, defeating corrosion and at the same time making good use of salvaged materials.

In one case on a Midwest power company system where the overhead wires of a 66-kv. line terminated at an anchor tower several hundred feet from the terminal station a buried ground wire was required to tie in

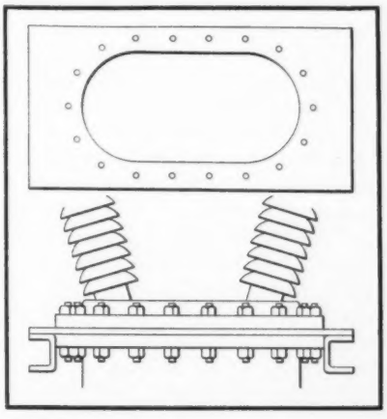
From paper "Grounding Practices in Substations," by E. A. Swanson, before Missouri Valley Electric Association engineering conference, March 26.

the anchor tower to the station ground. A size of 250,000 cir.mil was specified and through corrosive cinder filled ground.

Having in mind priorities and critical material, company engineers hit upon some old 15-kv., three-conductor, No. 0 lead-covered cable about to be junked for copper salvage. This cable was trenched in between the anchor tower and substation, serving admirably the combined copper, corrosion, priority and lightning needs. For further assurance of its capacity, the three copper conductors were bonded to each other and to the lead sheath every 50 ft. *ITEM 74*

Modernizing Old Oil Circuit Breakers

MOST modern outdoor type oil circuit breakers are designed to be supported in a structural frame and the tanks

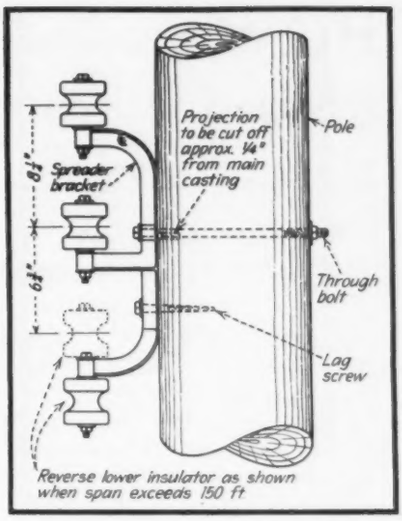


FLANGE PLATE for structural mounting of old breaker

can be lowered to permit access to the working parts. But there are many breakers of older design with tanks that stand in bases set at ground level. These breakers are troublesome to maintain because the working parts must be lifted out of the tanks, often requiring complete disconnection of leads. Some of these older breakers, replaced by later designs, are now being rehabilitated with new parts and put back into service on account of present difficulties in obtaining new equipment. A Southern power company adapts these older breakers for installation on supporting structures in the manner shown in the accompanying drawing. A plate of ½-in. steel is cut and drilled so that it can be set between the tank and top of the breaker. The plate projects at each end to provide flanges by which the breaker is supported in the structure. *ITEM 75*

Spreader Brackets Converted to Racks

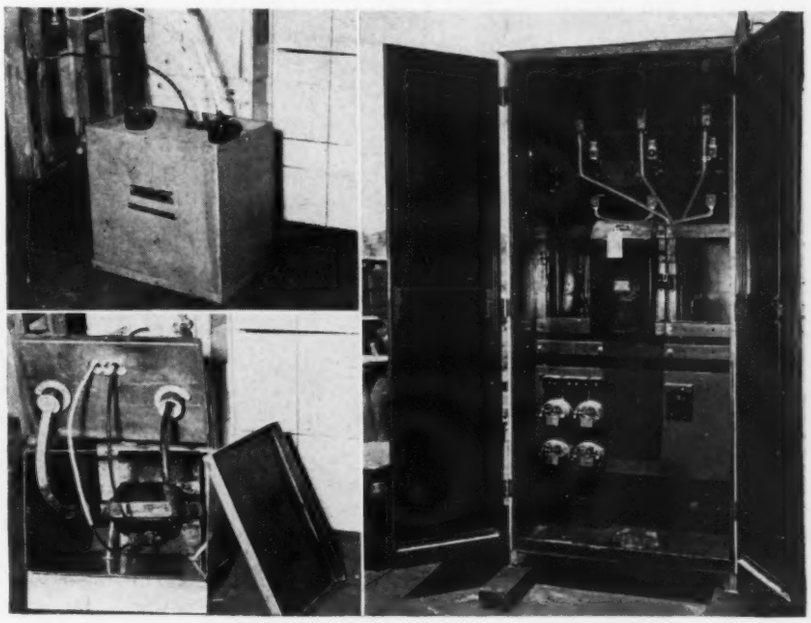
THREE-POINT spreader brackets of the type shown are no longer being purchased by one Eastern utility because crossarms are steadily being eliminated; those on hand are being converted to secondary racks for three-wire runs. In fact, the type of rack construction shown is prescribed for most situations in order to use up the stock of spreaders. Another form of spreader using pin-type insulators is also being converted to rack application. In this instance the middle member of the bracket is cut off and attached separately to the pole below the remaining two-insulator portion so as to accommodate three-wire secondary runs. *ITEM 76*



STOCK of spreader brackets altered as shown to serve as 3-wire racks for secondaries

Indoor Equipment Adapted to Outdoor Use

REPRESENTATIVE of the extent to which equipment designed for use indoors is being housed against weather and put to work outdoors are the accompanying pictures taken in a Southern utility shop. At the left are open and closed views of a current transformer set in a metal box with removable top and bottom. The transformer is securely mounted on a crossplate and is easily accessible. Nameplate with ratio and other data is removed from the transformer base and fixed on the outside of the box. Picture at the right is of a complete assembly of oil circuit breaker, disconnecting switches, meters, relays, etc., all wired up in a waterproof housing and ready to be installed as a unit. *ITEM 77*



CURRENT TRANSFORMER and assembly of substation equipment housed in steel for use outdoors

HOW scarce materials are being salvaged for reuse

Used Line Hose Salvaged by Sanding

THE LABORATORY of a Midwest utility has found that life of rubber line hose which has begun to show the effects of surface aging in the form of checks and cracks—alligator skin—can be safely extended from eighteen months to two years by mechanically sanding the surface of the hose down to the live rubber underneath.

In most cases the aged rubber does not extend more than $\frac{3}{32}$ in. below the outside surface. Below this sufficient live rubber remains after resurfacing, so that the hose retains a safe margin of breakdown strength under test.

As shown in the accompanying illustration, a high-speed sander operating at about 17,000 r.p.m. is used for this work. An 8-in. disk of No. 1 sandpaper, either with or without backing to give it stiffness, is mounted in the chuck of the sander.

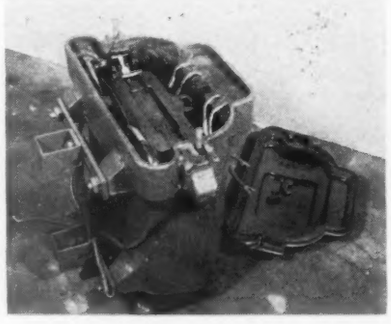
After a little practice most operators are able to resurface three 6-ft. line hose per hour. Assuming a labor cost of $1 per hour, it is thus possible to reclaim a $10 line hose at a cost of about $0.35. *ITEM 78*

MISSOURI UTILITY salvages used line hose by sanding away aged surface rubber. Live rubber beneath retains safe insulating strength.

Old-Style Transformer Rebuilt for Emergency

POLE-MOUNTED transformers of the vintage prior to the advent of silicon steels are quite obsolete, having an iron loss of about 2 to 1 and a total loss of about 1.3 to 1 as compared with the modern unit. Small electrical clearances, both inside and out, render them quite vulnerable to sparkover during surges of average intensity. However, they seldom burn out unless severely overloaded. Their cast-iron tank seldom is troubled with corrosion. But they can and will blow fuses in rapid fashion.

One Midwest utility has decided that it would be unwise to salvage such units unless the sparkover defect can be easily corrected. Yet this can be done at the average cost of one fuse replacement. The terminal board is removed and discarded, tap leads cut off and taped up, bushing pockets bored out to accommodate a more modern gooseneck type bushing, the dirty oil cleaned or replaced; sludge removed, cover gasket renewed and a simple universal adapter added to the mounting lugs ready for installation on the new NEMA standard through-bolt spacing, for the duration of the war emergency. Direct cost of this rehabilitation is nominal and the amount of material used is less than if the unit had been discarded and replaced with a new one of slightly lower total losses. *ITEM 79*



OLD-STYLE distribution transformer as rehabilitated to correct sparkover faults; rebuild described cost less than one fuse replacement

From paper "War on Waste," by Lawton M. Limpus, presented at Missouri Valley Electric Association.

Reclaim Connectors The Easy Way

WITH copper and copper products on the "short" list, mechanical connectors are an easily-salvagable item of real importance. They can be reclaimed without great cost if a little attention is given to methods of removing tape and tar residue and an effective brightening solution.

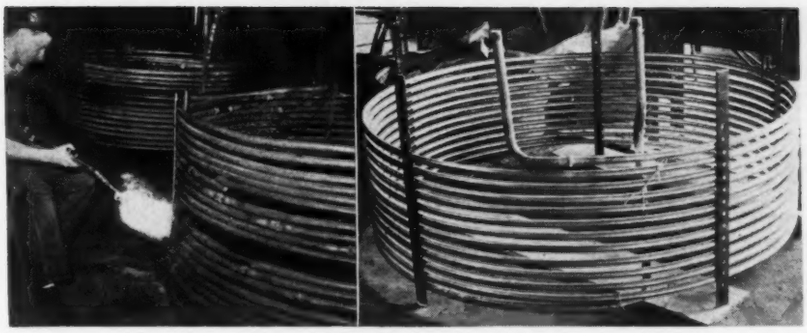
A Central States utility finds that an effective way to remove tape is to put connectors in an old rocking type washing machine or other agitating machine with kerosene or a commercial solvent such as Stanosol and agitate for 24 hours. At the end of this time the tape will fall off or can be pulled off easily.

After the tape is removed the connectors are cleaned in a cold liquid cleaner, such as Magnus No. 78, which removes any remaining oil or grease. A hot potash solution may also be used for this purpose.

If a brighter finish is desired the connectors may be bright dipped in a solution of sulphuric acid 100 parts, nitric acid 75 parts and hydrochloric acid or common salt 1 part. Due to the many variables and the changing composition of a bright dip in use, as well as different compositions of connector metal, it is impossible here to set up complete instructions for this process. *ITEM 80*

Transformer Cooling Coils Salvaged

WHERE normal practice has been to junk copper tubing from transformer cooling coils a Pacific Coast utility company has developed a successful technique for salvaging this critical material. Usually such used copper tubing is in extremely bad condition when salvage is attempted. Not only is it dented and twisted but in sections



WORKMAN ANNEALING sections of used copper tubing from transformer cooling coils which have been salvaged. At right, transformer cooling coil was fabricated from salvaged copper tubing that was cleaned, straightened and annealed

where hard water is used for cooling there is heavy accumulation of lime deposit, which is difficult to remove.

At the utility's central warehouse and shops it is the practice to make individual chemical analyses to determine the character of this scale. Then it is possible to select the proper solvent for removing the deposit. Solvent is placed in the tubing under pressure until the lime dissolves. In bad cases of scaling it is sometimes necessary to use pure muriatic acid as a solvent. Where this is employed care is taken immediately to clean the tubing thoroughly.

After the lime deposit is removed the tubing is straightened, annealed and then refabricated into new transformer cooling units. *ITEM 81*

Scrap Pipe Lagging is Easily Salvaged

USED 85 percent magnesia heat insulation used in lagging pipes and boilers is broken up and molded into blocks that can be put back into service at the salvage shop of a Midwest utility comapny. The process is shown in the accompanying illustration.

Used insulation of all shapes is first broken up and put through a small hammer mill, where it is shredded. This material is then mixed with water in the mobile cement mixer shown. About 150 gal. of water is added to about 720 lb. of shredded material. The plastic mass is then put into sheet metal pans 6 in. wide, 18 in. long and from 2½ to 3 in. thick, vibrated and troweled to a smooth top finish. These are placed in an air drying oven, where air warmed by steam coils is blown over them. After three to seven days in the oven the moisture is completely removed from the blocks and the blocks can be slipped out of the tins and stored in stacks for reuse. *ITEM 82*

USED 85 percent magnesia heat insulation is here being molded into blocks for reuse. Note cement mixer at right, vibrating table in left foreground and drying oven in background

Steel Plate from Transformer Tanks

WHERE new supplies of critical materials are limited it is possible to obtain usable emergency stocks by the reclamation of what heretofore has been sold as junk. A West Coast utility is reclaiming all steel plate from obsolescent transformer tanks that previously were disposed of as steel scrap. At the company's central warehouse workmen use oxyacetylene torches to cut tanks into usable sections. These are then sent to a nearby steel fabricating plant where they are rolled flat. Plates of various gages are then stored until needed. In this manner it has been possible to obtain steel plate for fabricating tanks for reclaimed oil switches, for the construction of underground junction boxes and other purposes. *ITEM 83*

WORKMAN CUTS UP an obsolete transformer tank to reclaim steel plate. Note that a square section has been reclaimed from tank top in foreground

Life of Used ACSR Determined by Test

TWO simple standard tests have been used by a Central States utility to determine if the life expectancy of salvaged ACSR conductor removed from service is sufficient to justify the cost of reuse. Both tests, which are used interchangeably, involve investigation of the integrity of the galvanized coating remaining on steel strands of the cable. Service life of ACSR depends on amount of galvanizing remaining as rust protection on the steel wires.

Tests used are (1) the "Preece test" and (2) the standard ASTM "stripping test."

In the Preece test a sample of the

coated steel core is dipped in copper sulphate solution for successive one-minute periods and inspected after each dip for copper deposits on iron, indicating the presence of fissures or cracks in the galvanizing. If the core wire shows no copper deposits after four one-minute dips it is considered adequately coated to permit reuse.

The ASTM stripping test is based on the actual weight of galvanizing on a square foot of core wire surface. Stripping of the square foot of sample may be done mechanically or with a suitable acid using antimony chloride as an inhibitor to prevent damage to the iron. In both cases the sample is weighed before and after stripping is completed and the weight of galvanizing determined by subtraction.

Specification for new cable usually calls for a minimum of 1.1 oz. of galvanizing per square foot of core wire surface. If by test it is found that an excess of 0.8 oz. of galvanizing remains per sq.ft., cable is considered sufficiently protected to justify the expense of restringing it. *ITEM 84*

How Short Can Wire Be Spliced Economically?

MINIMUM LENGTHS of salvaged wire that can be spliced economically have been carefully calculated for each standard size and type of wire used on the system of a Great Lakes utility as part of the material conservation program of that company. In making these calculations, items of splicing cost, such as (1) cost of labor for making the splice, (2) cost of the sleeve, (3) cost of tape and compound and (4) value of the minimum length of wire as junk, are balanced against the cost of a minimum length of new wire.

These factors involved in the determination of the minimum length of copper that can be spliced economically can be expressed as a simple algebraic equation as follows for a given size wire:

$XA = \frac{1}{4} B + \$0.12 + \$0.02 + XC$ in which

X = weight of copper corresponding to minimum spliceable length of a given size wire that can be spliced economically.

A = A constant equal to the price per pound of new wire.

B = A constant equal to the hourly labor rate.

C = A constant equal to the junk price of copper per pound.

The factors \$0.12 and \$0.02 are the costs of sleeve and tape required for a splice of a given size. Solving this simple equation for X gives the weight of the shortest economically spliceable length of wire under prevailing unit material and labor costs.

All wire sizes from No. 8 to 3/0 are salvaged by this company with a sleeve type compression splice and a standard commercial splicing machine. Types of wire salvaged in this manner include double grade weatherproof, bare, candee, tree wire, and copperweld. For each of these types and sizes, the minimum economical splicing length has been determined as shown.

SPLICING MACHINE being used on No. 8 weatherproof wire

Before the compression type sleeve splices were adopted by this company tests were run on the conductivity of splices. It was found that conductivity averaged 180 percent of that of the unspliced wire. In tension tests spliced conductors failed outside of the splice. Other investigations indicated that because of the nature of the ABC type sleeve used there was little chance of deterioration in conductivity of the splice with age and that the finished splice after taping will run freely over crossarms, during stringing operations, because of (1) the beveled ends on the splicing sleeve and (2) because when splicing and taping of the joint are completed the diameter of the splice is very nearly the same as that of the original wire.

In taping tree and candee wire splices an attempt is made to simulate insulating qualities of original. Tree wire splices are taped as follows:

1. Two wraps of ¾-in. Okonite rubber tape with one-half overlap, with Okonite rubber cement applied between layers.
2. Two wraps of ¾-in. linen tape, each layer coated with DMC compound.
3. Two wraps of ¾-in. friction tape, half overlapped and an outside coating of DMC compound.

Use of the DMC compound on the outside of the splice keeps tape from loosening and fraying. Prior to taping tree wire insulation is stepped down about half its thickness for about ½ in.; in this way leakage through and around the taping is reduced.

In taping candee wire the splice is covered as follows:

1. One layer of rubber tape, half overlap, coated with rubber cement.
2. Two layers of friction tape, half overlap, coated on the outside with DMC compound.

These methods of reclaiming line conductors have been used by the company since June, 1938. In the period since that date and up until March 1, 1941, the following amounts of wire have been reclaimed: Weatherproof, 168,000 lb.; bare, 23,000 lb.; tree wire, 14,000 ft. *ITEM 85*

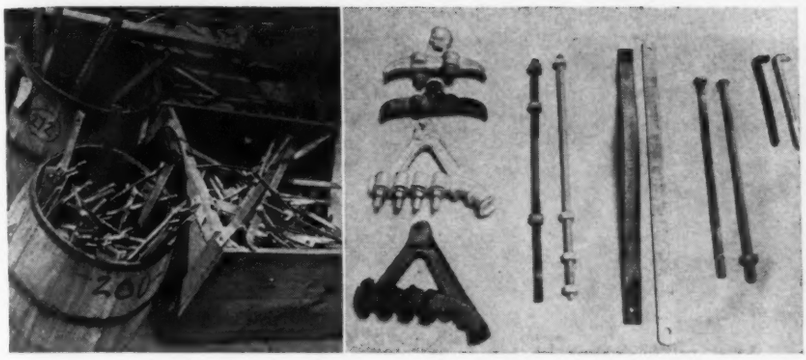
Battery Bar Copper Salvaged for Use

A UTILITY in the Northwest decided that a lot of bar copper could be salvaged for use from an old Edison battery, instead of merely scrapping the metal. The bars are being sheared and reconditioned for use in outdoor distribution substations in the same manner that copper sheet tubing is ordinarily used. When it is necessary that the bars be of considerable length, they are joined either by "Silfos" brazing, or mechanically by bolting or clamping. By shearing the bars in the recovery operation no metal is lost, as with sawing. *ITEM 86*

Pole Line Hardware Reclaimed

SCRAP PILES hitherto sold *en masse* to a junk man can be mined with profit during the war emergency if the experience of a West Coast utility is any criterion. In the case of pole line hardware upward of 80 percent of what formerly was sold is being successfully reclaimed to alleviate material shortages.

This type of hardware is now being accumulated in the company divisions and periodically forwarded to the cen-



BEFORE THE DAYS of critical materials the contents of these boxes and barrels were labeled "junk"; today 80 percent of it is being reclaimed. At right, before and after comparisons of renovated pole line hardware

tral warehouse. There it is segregated and renovated, where this is feasible. Stubbing bands and crossarm braces are straightened and then galvanized. Machine bolts are trimmed up on emery wheels and the threads rerun. If the bolts are beyond repair, then the nuts are salvaged. Conductor clamps are cleaned and regalvanized. Nothing usable is scrapped. *ITEM 87*

Pole-Top Pins and Machine Bolts From Salvage

A LARGE NUMBER OF $\frac{5}{8}$x7-in. busing bolts on hand by a Western utility were of no further use. Cutting these in two, they have utilized the two parts in ingenious ways to affect material savings very well worth while. Heretofore they have been using standard pole-top pins with stringing hook on the side (picture at left). From salvaged materials, including the busing bolts, they are now able to make similar pole-top pins.

Taking the busing bolt as shown in center picture they cut it at a point $\frac{1}{2}$ in. above the shoulder, leaving the cob end with a bit of this squared portion on it. Next, they take a 15-in. length of angle iron 1$\frac{1}{2}$x1$\frac{1}{2}$x$\frac{5}{8}$ in. (of which they have plenty as part of an obsolete type of transmission brace), point one end and in the angle of the pointed end weld the cob as shown in the right-hand picture. The small amount of squared end left on the cob fits into the angle snugly and helps hold it in place while welding. Then a piece of $\frac{1}{2}$-in. round is bent and welded on the side for a stringing hook. After drilling holes in one side of the angle for bolts, they have as neat and strong a pole-top pin as could be desired.

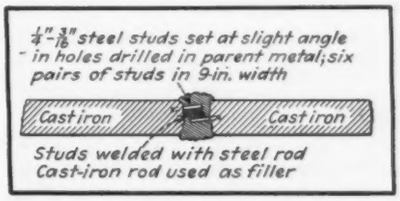
But that is not all the story. The other part of the busing pin that was cut off with a generous squared head on it makes a first-class machine bolt for which there are constant uses. The shoulder below the squared portion now acts as a washer for the bolt, and one that will never come off and get lost. *ITEM 88*

MAKE pole-top pins from salvage

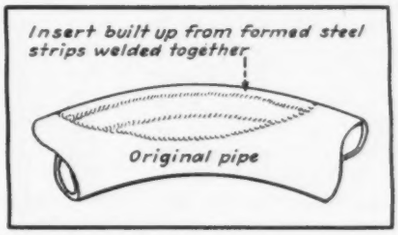
Pipe-Stoker Parts Salvaged By Welding

BROKEN stoker secondary rams and similar cast-iron parts around power plants that in peacetime would normally be scrapped are being carefully mended and reinstalled in several plants of a Great Lakes utility to conserve materials and manufacturing schedule time. Two such repair methods are shown in the accompanying sketches.

In the case of the stoker rams, the breaks are first carefully cleaned and high points ground off. Several pairs of short steel studs of $\frac{1}{4}$ to $\frac{3}{8}$ in. diameter are driven parallel to each other and at an angle into drill holes in the parent material to provide a bearing for steel weld metal which forms the center of the repair weld. Cast-iron weld metal is used as filler and built up over the steel core as indicated to complete the repair. Stoker parts can be repaired satisfactorily in this manner, if they operate in a fairly cool section of the stoker and if the cast-iron part to be welded has not been "burned."


¼"-⅜" steel studs set at slight angle in holes drilled in parent metal; six pairs of studs in 9-in. width
Cast iron
Cast iron
Studs welded with steel rod
Cast-iron rod used as filler

SECONDARY RAM for underfeed stoker repair



INSERT REPLACES abraded pipe section in hydraulic ash removal system

Cast-iron pipe in hydraulic ash-disposal systems frequently wears through and fails at bends under the abrasive action of ash. Pipe sections that have failed in this manner are also being reclaimed by welding at the same plant. The worn section is knocked out and an insert prepared by welding strips of mild steel together and forming it to the general contour of the pipe at the bend. Before

installing, the inside surface of the insert against which the ash and water will impinge is coated with a wear-resisting metal by arc welding. The insert is then welded into place and the pipe section set aside for reuse when needed. Many feet of valuable pipe which would otherwise be scrapped have been reconditioned in this manner and are proving entirely satisfactory in service. *ITEM 89*

Lead Stripper

AN OLD pipe-threading machine, vintage of about 1900, stands in the material salvage shop of a Southeastern power company. It is an heirloom from a small gas utility taken over some years ago. It would have been junked but the presiding genius of the salvage shop did not like to see a good machine go that way. He kept it, thinking it would come in useful. And it did when the job of stripping the lead from a lot of obsolete cable was up for doing.

The machine had a chuck in which the thread-cutting die was held. In line with this was a circular vise arrangement to hold the pipe being threaded. It was a simple matter to fit this vise with a bearing in line with the chuck. Rolling in this bearing, held and turned by the chuck, is a short piece of shafting that once was in the drive axle of a truck. The shaft once had a collar on it. This collar was ground down to a circular cutting edge. Another circular knife, running free on a shaft that can be raised and lowered according to size of cable being cut, was set below the power knife. The cable is thus cut longitudinally, top and bottom, and the lead comes off in strips. *ITEM 90*

Separating Steel from Scrap ACSR

JUNK ALUMINUM is not worth much if it has steel mixed up in it. And quite a lot of unusable ACSR conductor comes into the salvage shop of a Southern power company. Problem was to separate the steel from the aluminum. To unstrand the conductor was an impossible job. The solution found was to cut the ACSR into short pieces, about 4 or 5 in. long, and the strands then would fall apart. To separate the pieces of steel from the pieces of aluminum was a job for an electromagnet.

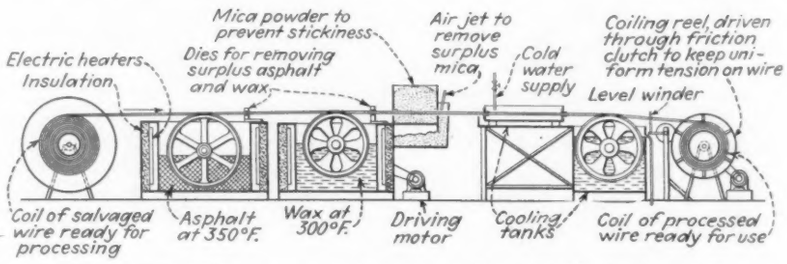
The magnet was made by slipping a pair of old exciter field coils on the legs of a yoke easily constructed of a couple of pieces of 3-in. shafting with steel cross-piece of square section. The magnet, energized by direct current, is mounted above a table on which the mixture of steel and aluminum pieces is spread out.

The steel jumps to the magnet, the aluminum is brushed off, the magnet is de-energized and the steel removed from it and the table is ready for more. *ITEM 91*

Saturate and Wax Braid of Old Wire

THE quantity and value of weather-proof wire used on utility systems and the problem posed by its inevitable return to salvage departments with various degrees of disintegration of weather-resisting compounds has led one Missouri utility to develop its own resaturating and rewaxing process for cotton braids.

As shown, it is a continuous process in which used wire passes (1) through asphalt at 350 deg. F., (2) through a heated die, (3) into finishing wax heated to 300 deg. F., (4) through a second heated die and powdered mica treatment to (5) a chilling process.


Mica powder to prevent stickiness
Air jet to remove surplus mica
Coiling reel, driven through friction clutch to keep uniform tension on wire
Electric heaters
Insulation
Dies for removing surplus asphalt and wax
Cold water supply
Level winder
Coil of salvaged wire ready for processing
Asphalt at 350°F.
Wax at 300°F.
Driving motor
Cooling tanks
Coil of processed wire ready for use

CONTINUOUS PROCESS saturates and waxes weathered braid of salvaged line conductors

For the hot asphalt a double-walled tank was built from scrap sheet iron and provided with an idler drum (improvised from an old pulley) having a pipe shaft resting in open bearings welded to the tank sides. Between the tank walls electric space heaters were installed. These were of sufficient size to maintain 350 deg. F. when regulated by a bulb thermostat installed in the inner tank. Space heaters were mounted on transite sheets and the space between transite and outer wall filled with salvaged asbestos heat insulation.

The wax tank, operating at 300 deg. F., is a duplicate of the asphalt tank except that a power drive has been provided to pull the wire off the reel, around the asphalt idler drum and through the first heated die. This was an old iron truck wheel complete with bearing, shaft and oil seal from the truck rear-end assembly. When mounted in the side of the tank they served as support, drive shaft and seal for the wheel in the wax.

The heated dies were constructed by boring a block of iron to receive a standard ring-heating element in a groove. The die proper was made of hard tool steel, cone shaped, so as to make it interchangeable for different wire sizes. The outside diameter was the same for all dies. The die used after the asphalt treatment is ten thousandths of an inch smaller than the one which follows the wax applications.

A hopper to hold the powdered mica was constructed of wood with a hole in each side, to allow the wire to pass through without touching. The wax is plastic when hot and would be damaged by touching anything hard before cooling. Baffles were provided to prevent mica from flowing from the holes. A low-pressure air jet blows surplus mica into a storage chamber under the mica hopper.

It is necessary to set the hot plastic wax quickly, so an open top chilling pan was made of sheet iron with a hole in each end large enough to clear the wire without touching the edges. Fingers from scrap rubber gloves, with tips clipped off, are used as water seals, permitting the wire to pass into and out of this preliminary water bath. This bath sets the wax sufficiently to allow it to be pulled, without damage, around an idler pulley in a cooling tank of running water.

Pulling the wire from the wax treatment tank and through the mica and cooling processes is done by a power-driven take-up reel consisting of the gear reduction from a scrap washing machine (for speed reduction). The axle, bearing, brake, drum and brake bands of a scrap automobile provided the friction clutch necessary to keep the wire taut at all times. The friction clutch is necessary because of varying diameter of the coil of wire as accumulated. *ITEM 92*

Wire Cables For Concrete Reinforcing

WITH the scarcity of reinforcing steel, it pays to look around locally and see what obtainable scrap steel might be used instead. A Northwest utility did look around, to good effect. It was found that there was considerable steel cable of the Tacoma Narrows Bridge, which failed some time ago, that was about to be scrapped. After getting the assurance from Roebling's representative that this six-strand cable could be successfully "unlayed," a quantity of this extremely high-strength steel cable was secured.

The company is having this cut into desirable lengths by means of the oxyacetylene torch, and then having the strands, each approximately 3/8 in. in diameter, untwisted. Burning in this way "seizes" the ends of the strands by welding together the nineteen individual wires which make up each strand, so that the strand will not ravel. These pieces of cable strand have been used extensively as concrete reinforcing material. *ITEM 93*

Engineering Liaison Guides Salvage Use

TO SPEED the turnover of salvaged material returned to stores by construction crews of a Midwest utility company a liaison man from the engineering department of the company participates with the stores department in the daily sorting of scrap materials. Through this arrangement the engineering department not only has a voice in the selection and rejection of hardware for salvage but is kept informed of the sizes and types of used materials available for allocation to jobs under consideration, permitting job material specifications to be keyed to reusable methods. In the case of wire and cable, for example, this practice reduces the amount of new wire drawn from stock in short lengths when salvaged wire in nearly exact length is available.

The accompanying illustration shows a day's accumulation of returned material being sorted at the storeroom and prepared for salvage. In the foreground a man with safety goggles is breaking up porcelain equipment to recover junk metal. *ITEM 94*

ENGINEERING and stores coordination in sorting of salvagables leads to more effective use of material

Cardboard Cartons Reconditioned

PAPER SHORTAGES need have no effect on the safe and careful packaging of materials shipped from a central warehouse to system substores if the practice followed by a Pacific Coast power company is adopted. Since the beginning of 1942 all used cardboard cartons have been salvaged and reused.

Prior to January 1, 1942, new cartons were used in making broken package shipments of miscellaneous materials from the main warehouse to division stores. Since that time all substores have been instructed to accumulate and forward to the central warehouse all used cartons regardless of condition. These cartons are then reconditioned and put back into use.

Only a few cartons have to be scrapped because of their damaged condition. Results of this salvaging program have been excellent. Since the practice was adopted no cartons have been purchased by this power company. *ITEM 95*

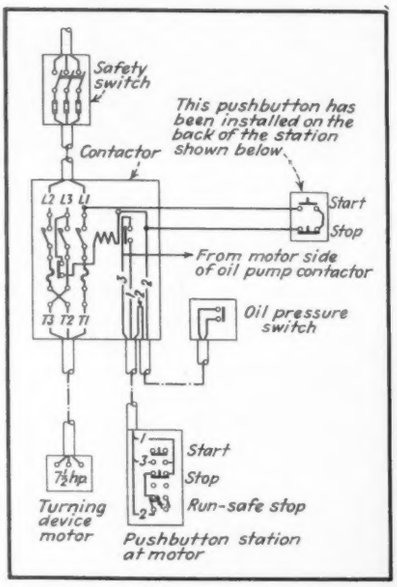
THIS STACK of used cartons was shipped from division substores to the central warehouse for reconditioning and reuse, thus saving large quantities of paper products; only new cartons were used heretofore

HOW maintenance is being facilitated

Turbine Maintenance Aided by "Shorting" Oil Pump

MAINTENANCE WORK on a 40,000-kw. steam turbo-alternator in an Eastern central station has been facilitated by installing a push-button type of short-circuiting switch behind the turning gear motor starting switch to make possible the operation of the turning gear without operating the motor-driven turbine oil pump. The turning gear motor is rated at 7.5 hp. and the oil pump motor at 3 hp.

Normally the controls for these units are interlocked. With the above set-up, the rotor can be "jacked" around a fraction of a revolution. To counteract the possibility of trouble in the push button, which would result in the rotor rolling without a flow of lubricating oil, a second stop button has been provided to break the circuit. That is, should the "Start" button stick in a closed position the additional "Stop" button may be used to open the circuit. *ITEM 96*



WIRING DIAGRAM for by-passing oil pump motor

Coating Stops Rust on Salvaged Hardware

BEFORE salvaged hardware is returned to service on one Midwest utility system it is given a rust-inhibiting coating at the stores department by tank-dipping in a vaseline-base preservative containing chromium as an oxidation inhibiting agent. The preservative, applied after the part has been cleaned by buffing with a wire brush, forms a slightly greasy, weatherproof film over the metal, which protects it against rust. In the experience of company engineers, parts so coated have been returned to stores after exposure to the elements for as much as five years with the preservative coating still intact and the part free of rust.

This treatment has been used by the company for several years. It has completely eliminated regalvanizing—a noteworthy point in view of the current shortage of zinc—and as applied to all salvaged metal parts exposed to weather except those involving electrical contacts.

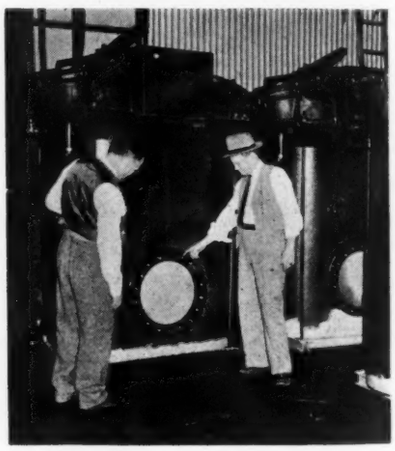
The preservative, known commercially as No-Ox-Id "A," has the consistency of heavy grease and is diluted for dipping purposes to a low viscosity fluid by adding cleaner's naphtha in the proportions of 12 lb. of preservative to 6 gal. of naphtha.

As shown in the illustration, the parts are dipped once on a small tank and set out on a rack to drain for a short time, then stacked on shelves for reuse. When dry the preservative gives the hardware a bluegray appearance, and although it has a slightly greasy feel it cannot be entirely rubbed off. It is not applied to new hardware. *ITEM 97*

VASELINE-BASE BATH containing chromium oxidation-inhibitor gives salvaged hardware a rust-proof coating; part is immersed once and laid out to drain on rack before stacking

Breaker Tank Manhole Saves Maintenance Time

WHEN high-voltage oil circuit breakers are brought into the shop of a Southern power company for repair they have added to them a feature that makes them much easier of maintenance than they were before. A manhole about 2 ft. in diameter is put into the side of the tank. When the breaker is in service it is not necessary to drop the tanks for inspection and maintenance of the breaker contacts. After the oil is drawn out the manhole cover is removed and the maintenance man can stick his head and arms into the tank and work on the contacts easily. This feature saves much labor and time in inspection and maintenance operations. *ITEM 98*



MANHOLES are put into breaker tanks in utility shop

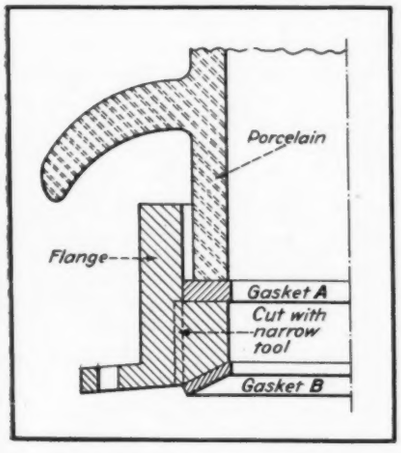
Water Walls Reduce Boiler Maintenance

ABOUT 4 percent increase in steaming capacity—important but not enough to justify the cost—was realized by a Southern utility from instal-

lation of water walls in six 250-lb. boilers in its main power station. What was important and what made the improvement worth much more than its cost was the reduction in burning of refractories and grates. Refractories are easy to obtain and are not expensive; cast iron is harder to get, but it does not cost much. But it is expensive to shut down a boiler and tear out old refractories and grates and put in new. Cutting these maintenance costs way down was what was accomplished by installation of water walls in these boilers. *ITEM 99*

Bushing Gaskets Rendered Replaceable

CORK RING GASKETS between flange and porcelain in certain older

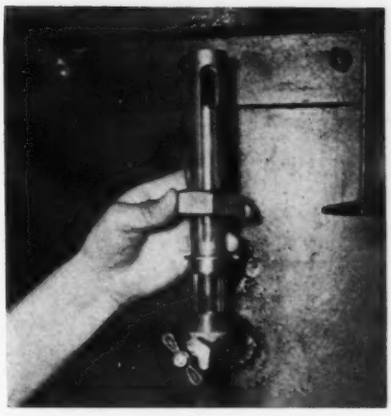


NARROW TOOL creates removable ring for replacement of gasket A at time of rehabilitation of bushing.

high-voltage bushings were not accessible for replacement because they were in a recess sealed in the cemented joint. In order to be able to maintain such gaskets when the bushing is overhauled an inner ring is cut from the flange in such manner as to release the gasket and make replacement an easy matter. *ITEM 100*

No More Broken Oil Gage Glasses

BROKEN glass tubes in transformer and breaker oil gages were an annoying item of maintenance to one Southern power company. The glass tubes were usually held in compression by the cap on the top of the gage and then a sudden temperature change would crack several tubes. To get



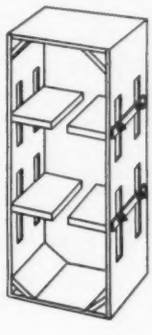
GAGE GLASS held tightly without compression

away from this trouble gages are rebuilt in the company's shop to a design that avoids putting the tube under compression. The idea is the same as that used for piston rod packing on a steam engine. A tapered ring of synthetic rubber goes around the bottom of the gage glass and is tightened up with a ring nut. The tube is thus held only at the bottom in a cushion seal and is free at the top. *ITEM 101*

Reusable Bushing Box

REPLACEMENT of high-voltage bushings on a widespread transmission system presents a considerable problem in the delivery of damaged bushings from the field to the repair shop and of repaired ones in the other direction. Crates in which bushings are shipped by the manufacturers do not last long in reuse on the system and, besides, each one is put together to hold one particular bushing and it is not readily usable for another of different size or type.

A Southern power company has a large shop where bushings are repaired and rebuilt for transformers and breakers all over the system. To facilitate shipping to and from the shop boxes of the kind shown in the sketch are used. There are two sizes of the boxes, each capable of holding one of several sizes and kinds of bushings. The box is made of 1-in. dressed lumber, securely braced at the corners and with a lid bolted on one side. The



flanges inside the box are removable and adjustable to fit different bushings by means of slots in the sides of the box. *ITEM 102*

Pole Reinforcements Save on Mountain Lines

TO REPLACE a weak pole on some of the steep cliffs encountered in the Appalachian range is an expensive matter. Labor, material and hazards are all averted by one utility by extensive use of Nepsco pole replacements in lieu of the chestnut and creosoted splices that used to be used. The reinforcements are readily driven down alongside the butts and then strapped and bolted to the exposed pole. The cost is approximately one-third the cost of transferring the pole to a concrete base because of the inaccessibility of the locations of the poles. *ITEM 103*

Substitute Metal for Clinker-Grinder Teeth

ABRASION-RESISTING grades of metal for hard wear points in power plant equipment are not so readily obtainable. An Eastern company has regularly used "Ni-hard" (SAF 262K) for both sizes of teeth in the clinker-grinder which serves the Taylor stoker. It has stood abrasion well and given little trouble from breakage. Now the company is using ABK metal obtained from American Brake Shoe & Foundry Company. It has a Brinell hardness of 250, against the 300 value of the Ni-hard teeth, but it is expected that only slightly less satisfactory life will be experienced in this service. *ITEM 104*

Small Governors Benefit by Added Lubrication

CERTAIN small turbine governors were found by an Eastern utility to incur undue maintenance and the trouble was traced to insufficient lubrication. The spindle was drilled and a flexible tube run to deliver supplementary oil to the upper end. From $200 to $300 is being saved annually in averted purchase of repair parts by this simple expedient.

In one of the plants the removal (and scrapping) of a plate-type air pre-heater from the stack breeching has given between 3 and 4 percent better station economy than when it was in service.

Rebushing and reboring of stoker ram boxes serve to keep coal from escaping to the pit. This work is done by local foundries and machine shops.

Wear plates are bolted (countersunk capscrews) to the edges of fan blades to give them renewed life and efficiency. *ITEM 105*

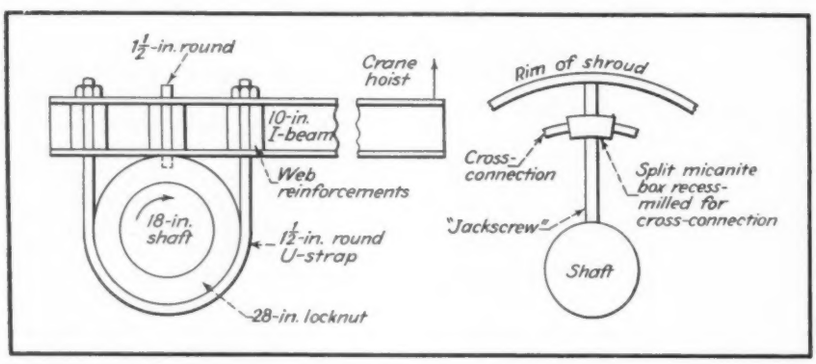
Arc-fused Field Coil Repaired in 5 Days

MANUFACTURERS' engineers said "it couldn't be done in the field," but the utility did it and a 20,000-kw. machine with a bad fault in the field coils was back in service in five days. A face-lifting type of surgery was performed and what might have been a three-month wait for the factory to get to this job because of prior commitments was a matter of less than a week to keep kilowatts rolling.

What was probably fatigue of metal caused a cross-connection between rotor coils to break and arc. All the manifestations indicated serious damage to the edgewise-wound coils, but it could only be partly seen through the vents in the shroud plate. The utility, however, would not agree to shipment of the rotor for factory repairs until the shroud ring could be removed and the extent of hidden damage ascertained. The 30-ton rotor was removed, cradled and blocked. A spanner wrench was fabricated and the 28-in. diameter locknut heated and removed, not, however, until it was found that what should presumably have been a left-hand thread was really a right-hand. The scalloped shroud plate was forced off and the coils were then accessible.

Three turns had been burned through and to within 1½ in. of the rotor. About 4½ lb. of copper had been melted and thrown off. After cleaning the gap area it was found that an inch of original mica insulation could be retained projecting from the rotor. New copper was brazed with phos-copper to the obliquely scarified ends. Mica sheets were packed around the turns and tied with glass tape, half-lapped. The finished job was doped with suitable enamel. Further vibration of the cross-connection was inhibited by a stiffener.

The machine was back on the line in five days, sooner even then it could have reached the factory, after testing the new joints for two hours with 150 percent current. It has now been carrying load satisfactorily for several months. *ITEM 106*

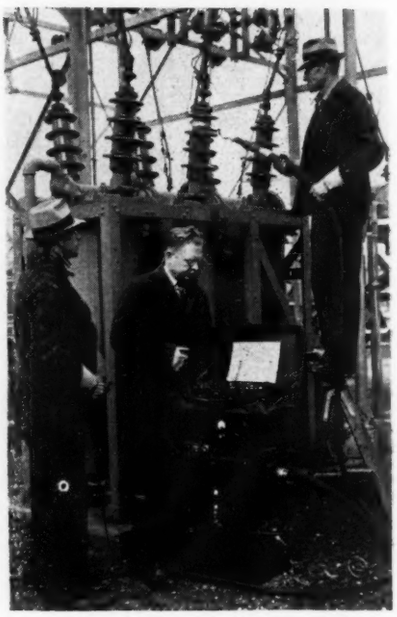


TEN-FOOT I-beam spanner-wrench loosens rotor locknut for access to damaged field coils of 20,000 kva. alternator (left). At right, new cross-connection braced by jackscrew and micarta box to prevent recurrence of vibration fatigue

Three-Part Program Protects Service

DUE to the practical difficulties of getting new transformers and breakers an Eastern utility will endeavor to protect an appropriate quality of service by more frequent and by more exacting tests of equipment. For example, in the substation department the company hopes to find sources of trouble before they develop into failures and for this reason is leasing Doble insulation test equipment.

Each of the two main division substation crews has been provided with the Doble equipment, which is mounted on a small truck. Oil samples are tested at the substation and if breakdown is below 25 kv. filtering takes place then and there, until the oil tests out OK. The two crews have been selected and trained so they can test, hot or cold, such equipment as bus insulators, transformers bushings, breakers and other pieces of equipment. *ITEM 107*



AS A PART of the company's three-part program to protect service in war-time, this crew has been provided with Doble test equipment and will test hot or cold equipment

Salvage Possibilities in Generating Stations

FOR SOME TIME a large Eastern utility has been reclaiming as much of worn parts of equipment as is feasible when consideration is given to the cost of material and the labor involved in the process of reclamation. Some of the important items which are now being rehabilitated are listed as follows:

The wearing surfaces of stoker crank shafts are covered with steel weld by an automatic welding lathe. The work is then finished in a machine lathe and the rehabilitated cranks are as good as new. This welding of worn surfaces is also done on the shafts of ash cars, lorry cranes, pump shafts and many other shafts.

Large circulating pump shafts which are about 6 in. in diameter and 12 or 14 ft. long are fitted with a renewable sleeve on that part of the shaft which runs in the packing. This sleeve suffers from wear as the result of packing friction, and these sleeves and shafts, instead of being scrapped, are turned off on the packing sleeve and fitted with a new thin sleeve

welded in place at the ends and finished in a lathe.

The water impellers of these large circulating water pumps suffer from wear on the vanes. These vanes are removed and new plate vanes welded in place and the work finished and surfaced with emery wheels making a smooth vane to pass the water.

The coal-handling equipment section and other departments of the generating station use a considerable number of cast-steel gears with cut teeth. When these teeth break or are badly worn, the damaged area is cut out and refilled with electrically welded steel. New gear teeth are then cut in place. This saves the cost of an entire new gear.

All valve stems, either of steel or cast bronze, can be straightened and covered with laid-on welding material and then refinished for use.

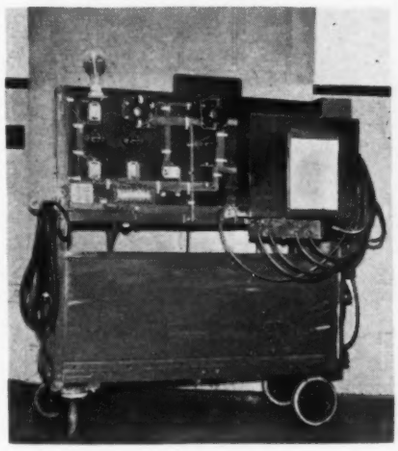
The surfaces of valve seats are built up by welding and finished and ground in place, thus saving the valve seats and the cost of their removal.

Electric contacts of oil switches are built up and then machined so that the contacts can be reclaimed and used for maintenance and repair of units in service. *ITEM 108*

Transformer Tests Safeguarded

ASSEMBLED mainly from materials on hand, a transformer test table designed by a New England utility has enabled this utility to speed up such work on a ten to one basis compared with the former methods, and to handle check-ups of ratio, polarity and insulation conditions between windings and between coils and cases with safety. The table is portable for use in laboratory, shop or field, and its wiring is permanent, outside connections being made by Tirex cord with convenient plugs. No test involving potentials of hazardous magnitude can be made without the simultaneous use of both hands by the operator in closing momentary push-button circuits energizing the wiring to the equipment undergoing check-up.

Transformers of 2,400-120/240-volt ratings up to 150 kva. are tested by this outfit. The table carries an ebonite panel for switches and testing studs and is normally wheeled to the transformer under test. Two of the wheels swivel for more flexible handling. A horizontal shelf for meters is located 36 in. above the ground and all wiring is installed behind the panel. Below the shelf are one 3-kva. transformer connected 2,400/120 volts and two 200-va. transformers of like ratio. The leads from the test set to the secondary of the transformer under test are arranged to prevent making a false connection, and when the 2,400-volt coil of the transformer to be tested is connected to the table these leads are not energized from the test set unless the proper safeguarded contacts have been momentarily established on the latter.



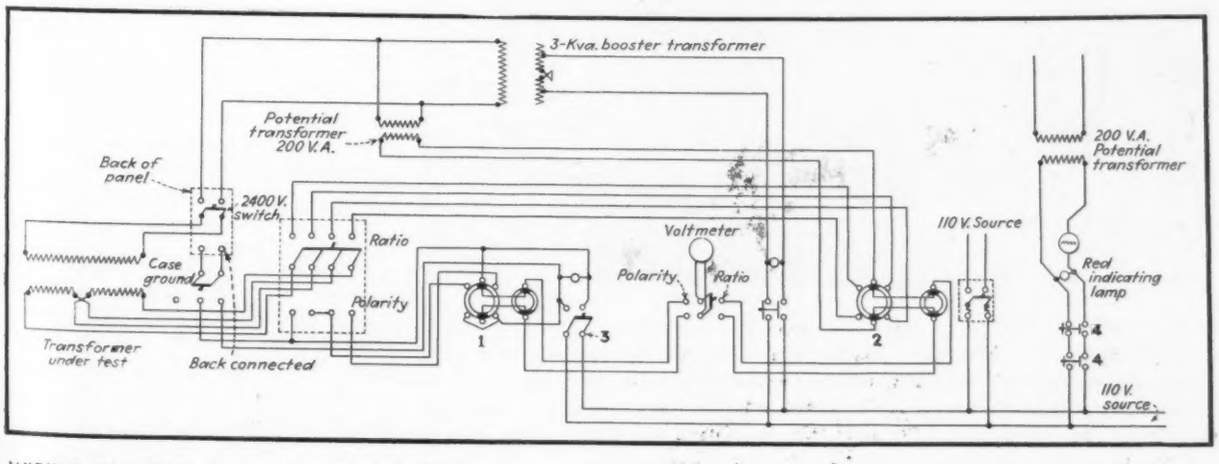
FRONT ELEVATION of test table

In the ratio test the transformer under check-up is energized from the 3-kva. transformer in the table base through a totally inclosed switch on the rear of the panel (operated manually from the front) and a momentary switch on the front. The latter cannot be closed unless the operator is in front of the table. The ratio test is made by comparison with a potential transformer of a proved ratio (20 to 1). A turntype voltmeter switch is provided.

In the high-potential test portable leads from one of the 200-va. transformers are arranged for use at the left end of the table only, and these cannot be energized until the operator pushes two momentary contacts simultaneously at the right-hand end of the table. It is impossible for the tester to use one hand to push the momentary switches and reach over with the other hand to come in contact with any exposed switches. Indication of condition is given by a pilot lamp at the top of the panel.

The polarity test is made through the 110-volt source with the switches arranged to isolate the transformer under test from all other equipment on the table. Voltmeter switching is again of the turn-type.

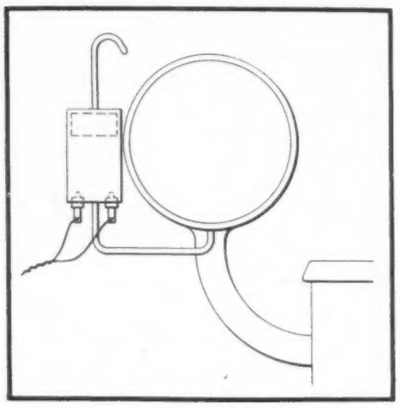
In a recent job 26 distribution type transformers were tested in 2.5 hours by this table. *ITEM 109*



WIRING DIAGRAM of transformer test facilities

Spark Plug Sentry Watches Oil Level

A SOUTHERN UTILITY has designed the low-oil-level alarm shown in the accompanying sketch; it meets the growing necessity for close watch



LOW oil level alarm for transformers and breakers

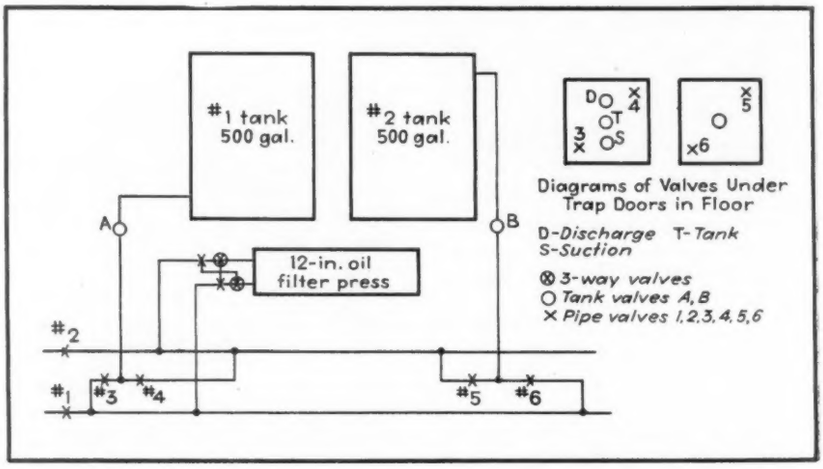
on equipment operation. Inside a brass cylinder is a hollow metal float. The bottom surface of the float is silver plated. Set into the bottom of the cylinder are a pair of spark plugs to which silver point contacts are fixed. If the oil level in the tank to which the device is attached drops to the danger point, the float goes down and rests on the spark plug points, closing the alarm circuit. *ITEM 110*

Spray Metallizer for Babbitted Bearings

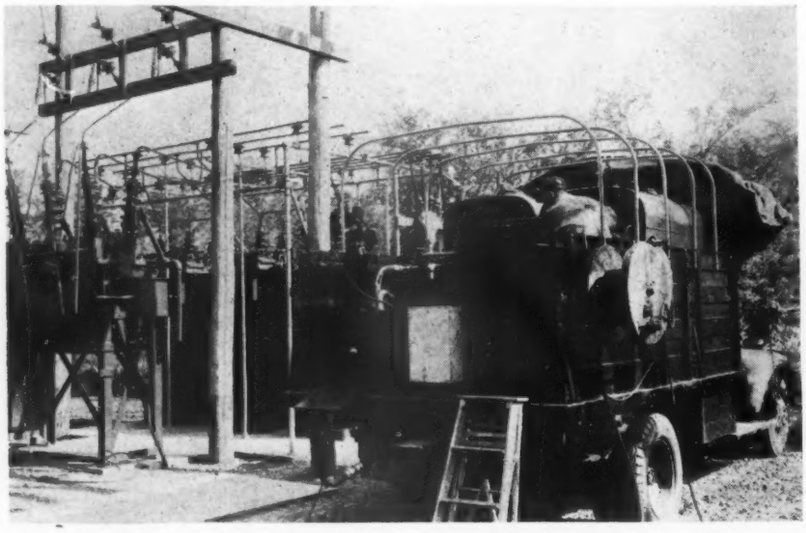
"ONE-TENTH THE TIME" is the conclusion of an Eastern utility as to the usefulness of a spray-metalizing equipment for building up metal surfaces. This particular time-saving figure pertains to the repairing of babbitted bearings as compared with the former method of melting down and remolding the babbitt metal.

Another example of tooling for reclamation is the increase in welding and flame-cutting equipment. Formerly the power plant shop had a single acetylene welder; now the valve, valve seat and similar repair and salvage jobs have justified the acquisition and use of two additional acetylene welders and two electric arc welding machines. *ITEM 111*

Multi-Purpose Maintenance Oil Truck



SCHEMATIC DIAGRAM of valves and piping to serve tanks, press and field equipment



INSULATING OIL TRUCK has removable canvas top, carries six 10-ft. lengths and six 3-ft. lengths of 1¼-in. hose, side boxes for pipe fittings and wrenches, skid planks, etc. Under old methods one 300-kva. transformer could be cared for in a day; with truck three 300-kvas. can be handled. Outfit was set up in ten minutes at substation shown to change or filter oil in three 333-kva. transformers. Truck can carry 55-gal. drums of oil and is a 4-ton Chevrolet also used for other purposes when oil equipment is removed

MAINTENANCE of equipment using insulating oil has been greatly facilitated on one New England utility system by the handling and treating truck illustrated. This carries filtering, pumping and tanking facilities which can be placed in the truck ready for service in two hours or dismantled in the same time. Piping is located under the floor in the main; trapdoors in the floor give access to valves and hose connections and permanent electric outlets speed up connecting for interior lighting, tests, spray and paint gun work, motor operation and other duties. Six normal tasks are provided for as follows in the numbered valve arrangements:

1. Filter oil from equipment in field through press into a tank. Close all valves. Attach long hoses to pipeline at 1 and to drawoff valve on equipment. Open drawoff valve and 1; open filter press valves; leave 3-way valves in normal position; open 4 and tank valve A. Start press: oil flows from equipment to tank 1.

2. Fill tank 2 after filling tank 1 as above. Close valves 4 and A. Open 5 and B. Oil then flows from equipment to tank 2.

3. Return oil from tanks through filter press. Consider all valves closed, tanks full and 3-way valves in normal position. No hose changes needed because of the 3-way valve attachment to the press. Open A, B, 4, 5, both filter press valves; put 3-way valves in abnormal position; open 1. Start filter press and oil will flow from tank 1 to tank 2.

4. Filter oil from one tank to the other through filter press. One tank empty. Consider all valves on the oil kit closed and 3-way valves normal. With tank 1 filled and oil to be passed through press into tank 2, open A, 3, both valves on press, 5 and B. Start press: oil flows from tank 1 to tank 2.

5. Return oil to tank 1 through filter press after it has been filtered into tank 2. Leave valves as in case 4 and put 3-way valves in abnormal position. Start press: oil flows from tank 2 to tank 1.

6. Circulate oil through press without using tanks. Consider all valves closed and 3-way valves normal. Attach hose to drawoff valve on equipment to pipeline on truck at valve 1, and other hose from pipeline on truck at valve 2 to a point on the equipment above oil level. Open valve on equipment; open 1 and 2, both press valves; start press. Oil then circulates from equipment through press back into equipment. *ITEM 112*

HOW operations are being simplified

Field Cable Repair Conserves Copper

FIELD REPAIRS of minor cable-sheath failures are among the operating innovation being practiced in certain instances by Middle Western utilities to conserve essential materials under present war conditions.

One Missouri company, for example, recently made such a repair when presence of oil at the duct mouth of a 33-kv. cable run indicated a break in the sheath between manholes. In this instance the cable in trouble was one of the top two in an eight-way fiber duct run encased in concrete and buried 3 ft. under the surface in a wooded area off the public highway.

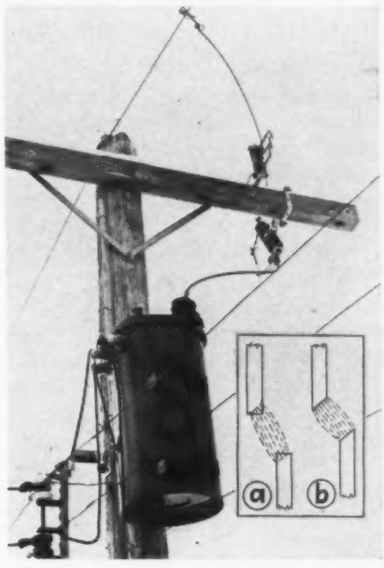
Rather than replace the 270-ft. cable section, as normally would be done under peace-time conditions, the underground department of the company drove test holes along the route of the cable (there was no paving over the duct line) dividing the run in half, and the remaining half in half, etc., until the break was found. Six holes were driven in all breaking through the duct envelope to the cable and looking for oil. Two short breaks in the sheath of the cable were found in this way; both short slits in the sheath within a short distance of each other. Both apparently were due to internal pressure within the cable. The repair was made by lead burning the sheath between the two breaks.

This type of repair was made possible by the facts (1) that the duct line was not under street pavement and (2) that the cable in trouble was one of the top two in the duct run. According to the underground department of the company there is some question as to whether the repair will prove permanent, since the character of the ruptures indicate a pressure condition in the cable at this point, which may lead to further sheath failures. However, the low cost of the repair and saving in material made possible justified the departure as an experiment. *ITEM 113*

Spill-Gaps Save Fuse Replacement Labor

EXPERIMENTS started in the spring of 1941 by a Western power company in connection with spill gaps on 12-kv. feeder lines have worked out so well that this practice is now being extended to practically the whole 12-kv. system. By July 1 of this year it is expected that the work will have been completed and approximately 12,000 spill gaps installed. With sometimes as high as a hundred fuses blowing in a single storm over an extended territory and as a result of lightning surges, it can be seen that the labor involved in sending men out to replace fuses was, in itself, a formidable item of expense. Protection furnished by the spill gaps eliminates most of this form of trouble, a very desirable feature at this time when labor is getting scarcer.

Reviewing briefly, early last spring



SPILL GAPS in Tee form extensively used to protect 12-kv. transformers; beveled ends of electrodes give more performance of gap adjustment.

one 12-kv. feeder out of Blackfoot substation was equipped with spill gaps (Matthews "Tee-gaps") and also fuses, which were coordinated not only with each other but with the substation feeder switch.

A second installation was made last summer on all three 12-kv. feeders out of Hansen rural substation. These gaps were also coordinated with fuses. About the same time a 4-kv. rural feeder out of Pocatello was cut over to 12 kv. and equipped with spill gaps and coordinated fusing.

After experience gained from these trial installations, they having gone through at least a portion of one lightning season, it was decided to equip the 12-kv. system as a protective measure against damage to transformers and the blowing of transformer fuses due to lightning surges. However, due to material shortage, it is not contemplated to carry coordinated fusing through all the feeders at the present time.

The method of installation of the

spill gap, between the line and the fuse, is shown by the accompanying illustration. It is a view of a typical installation on one of the company's transformer poles. The first gaps ordered had electrodes of the conventional type, with the ends cut off square. In operation, it was found that discharges across the gap tended to burn the edges and so ultimately change the gap setting (a in sketch). The company then had the design modified, beveling the ends of the electrodes (b in sketch). Not only does this design eliminate the burned edges and maintain the settings constant, but water running down the electrode drops off the point of the bevel for the most part and clears the lower electrode father than before. *ITEM 114*

Saving Wiping Solder in Cable Joint Making

AN ESTIMATED saving of 2,000 lb. of tin and 5,000 lb. of wiping solder yearly has been visualized by a power company serving several hundred square miles of urban, suburban and rural territory through a new method of wiping joint sleeves. This represents an economy of between 50 and 66 percent in solder requirements. To determine the possibilities of conserving wiping solder trials were made of a number of styles of wipes on straight joints.

A wipe of average appearance, neither full nor scanty, made on a carefully belled 5-in. sleeve in a 2⅝-in. cable required about 32 oz. of solder. A second wipe, similar except wiped very thin, required but 16 oz. of solder. Most economical of all was a style in which the sleeve was beaten into a conical taper about 3.5 in. long, with a small wipe about 1.25 in. long at the end of the taper. This last style required only 12 oz. of solder and could be made using even less without difficulty. All wipes withstood pressure tests successfully. Bending tests on the taper cable wipe resulted in cracking of the factory sheath.

Sample wipes have all been cut sectionally into several pieces. In the conventional wipe most of the solder is wasted. Although these standard wipes were made by one of the most skillful splicers in the utility, under ideal conditions, a number of voids were formed, which, though they would cause no leaks, did reduce the protective thickness of solder to considerably less in the case of the tapered wipe in which no voids were found. It was believed that this effect was the result of the greater opening between the sleeve and the cable, permitting better manipulation of the solder in the case of the taper wipe.

The advantages of the new tapered wipe are summarized as follows:

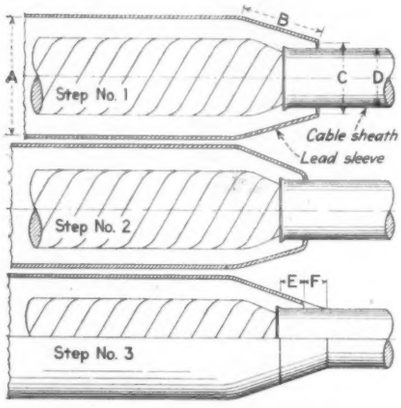
(A) Saves:

1. Solder. About 2.5 times as many wipes can be made with the same solder as for an average conventional wipe, and still more compared with full or belled wipes.
2. Sleeve length. The slight amount of sleeve length is gained by using the taper. As no joints require full diameter near the ends, there is no disadvantage.
3. Less filling compound is required.
4. The reduced wipe should require less time after equal experience. This may be offset by a slight increase in time to form the sleeve.

(B) Easier to Make:

1. Less skill is required to beat the taper into the sleeve without resultant wrinkles.
2. Much easier to tighten sleeve in place on cable—a rather difficult operation where a bell wipe is in place with the opening too large.
3. Easier to tin. The angle between the sheath and the sleeve is much greater, giving accessibility.
4. Easier to wipe. Less metal must be handled, reducing the tendency for the bottom to drop off. Also the shape of the wipe is more symmetrical, requiring less skill to handle. Wipes cool quicker.
5. The larger angle between sleeve and cable apparently causes all metal in the wipe to be worked during wiping, eliminating voids.
6. More uniform wipe. Considerable less variation in solder thickness circumferentially. There appears to be very little risk of a leak when solder is used sparingly for the tapered wipe, and it is much easier to judge what thickness of metal has been used.
7. Fireproofing the wipe will be easier due to the gradual change of diameter.

ITEM 115

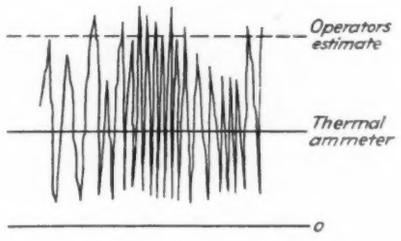


DIRECTIONS FOR MAKING cable joint with less solder. Step One—Beat in the lead sleeve, in a straight taper (see table), to an opening (C) that is ½ in. greater than the outside diameter of the cable sheath (D). Clean the ends of the sleeve for a distance of 1 in. and apply a coating of stearine. Also clean the cable sheath at and slightly beyond the area on which the wipe is to be made and apply stearine. Step Two—Tighten the sleeve on the cable sheath by beating in a short radius curve at the end of the taper. It is important that the sleeve be evenly fitted and tight entirely around the cable sheath. Step Three—Apply pasters (see table) to the sleeve and cable sheath and make a flat wipe.

Table of Dimensions

A In.	B In.	C In.	D In.	E In.	F In.
1	¾	¼ plus D	Diameter of Cable	½	½
1½	1	¼ plus D		½	½
1¾	1¼	¼ plus D		½	½
2	1½	¼ plus D		¾	¾
2½	1¾	¼ plus D		¾	¾
3	2	¼ plus D		¾	¾
3½	2½	¼ plus D		¾	¾
4	2¾	¼ plus D		¾	¾
4½	3	¼ plus D		¾	¾
5	3½	¼ plus D		¾	¾
5½	3¾	¼ plus D		¾	¾
6	4	¼ plus D		¾	¾

Fluctuating Load by Thermal Meter Indications



OPERATORS, in watching ordinary indicating instruments, were found by one Eastern company to be prone to estimate close to the maximum swings on fluctuating loads. This was because they were unable to make proper allowance for the duration of the swings and the relative length of the intervening interval. The result would, of course, be a log entry that would start moves for added capacity if the reported load was encroaching too much on the actual safe capacity.

Tests showed that the actual thermal loading of the equipment at times might actually be only half the value estimated by the switchboard attendant. The company is now putting fifteen-minute Lincoln thermal ammeters on all such circuits and thus deferring the apparent need for additional transformer, line or generating capacity. *ITEM 116*

Savings Hints For Line Department

IN A BULLETIN recently released to his crews, the line superintendent of an Eastern utility makes 26 suggestions which show specifically a number of the things which linemen can do to save materials, to save money, to save time, and to assist in the war effort.

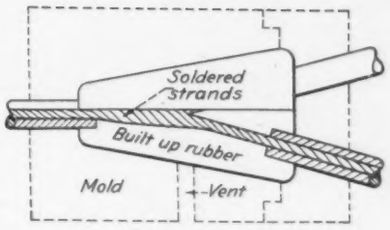
Following are the suggestions for the conservation of supplies, tools and equipment:

1. Plan all work carefully. Conserve time, energy and materials. Cooperation between departments is of utmost importance.
2. Do not use a six-pin crossarm when a four-pin crosswarm will do the work.
3. Use only one brace on each cross-arm.
4. When running wire, do not run out on the ground for measurement. Run wire, put in position, and pull up slack before cutting off the surplus.
5. Use No. 6 wire instead of No. 4 wire for services except where there is a heavy load or a range located more than four spans from a transformer.
6. Any piece of wire 10 ft. or longer must be spliced so it can be used again.
7. Do not scrap wire because the insulation is worn out.
8. When running secondary install line on service side of pole. Do not install racks back to back unless there are services on both sides of the street from that same pole.
9. Use insulating bolts and bare wire in extending primaries.
10. Use double spacing of poles wherever possible.
11. When installing guy do not use a three-bolt clamp at the insulator, but wrap it and dead-end it.
12. When guying primaries use an eye-nut on through-bolt of cross-arm.
13. When guying secondaries use an eye-nut on bottom bolt of rack.
14. Do not use guys where there is a light strain, but crib instead.
15. Do not increase the size of a transformer until a thorough study of the loading has been made.
16. Plug fuse boxes are not to be scrapped, but are to be used on 10-kva. Transformers or smaller where the primary voltage is 2,300.
17. Save all bolts and pieces of scrap wire and deposit them in a box in the storeroom.
18. On stormy days rethread and straighten bolts and return them to the storeroom.
19. Rubber gloves must not be used while climbing a pole. Stop at the secondary position and put on your gloves. Rubber is very hard to get and should be handled with great care.
20. Use great care when using rope. Do not let it ride on sharp angles or pull it along the ground. Keep your rope dry and free from grit.
21. When handling poles on a trailer be careful. Do not let the pole hit the truck. The trucks may have to last us a long time.
22. Avoid unnecessary trips and avoid taking two trips where one will do. Care must be used in handling automobile equipment, and not driving too fast. Do not stop short or go fast around corners, making the tires slide. Do not rub the tires against the curb. Keep them properly inflated.
23. Good housekeeping is urged, as it tends to save material, preserve tools and improve efficiency of employees in all departments.
24. Any suggestions for saving material, and for safety while at work, will be greatly appreciated.
25. Check your inventory of tools periodically to avoid loss, and keep them in good repair, for they also may have to last us for a long time.
26. In planning your work let these questions be your guide: Will it help win the war? Will it conserve energy? Will it safeguard health? Will it save time? Will it release materials for defense? Will it increase production? Will it promote better morale? Will it help your company?

ITEM 117

Vulcanize Plug Leads for Street Light Board

THREE-POINT (ground and circuit) plug leads get hard usage and often have given short life in one Middle Atlantic company's experience. In order to correct this condition the service shops fabricated a mold which is used to reinforce the junction of the three leads.



TWO-PART MOLD and electrically heated vulcanizing plate gives prolonged life of plug leads for street light circuit use

After the joint has been neatly soldered it is wrapped with enough layers of vulcanizing sheet rubber to build up to the conical form found most appropriate for long life of the assembly.

It has been the joint and not the leads, plugs or insulated handles which determined the service life of the assembly. *ITEM 118*

HOW efficiency of operation is being improved

Lance Boiler Tubes Through Special Ports

SPECIAL 6x12-in. cleaning ports giving access to superheater and first-bank generator tubes have been installed across the back of certain boilers at the plant of a Central States utility company. These ports allow air lances to be used parallel to the axis of the tubes instead of at right angles. It has been found that a far better job of tube cleaning can be done in less time with this arrangement.

Formerly tubes were cleaned from the side with the lances inserted at right angles through regular cleaning ports in the boiler setting.

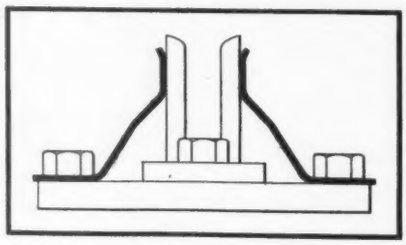
Boilers equipped with the special ports have the ports spaced on 21½-in. centers between down-corner headers. Each port consists of a 13¼ x 10½-in. frame of special heat-resisting cast iron the same size as standard sealing pile. No cutting and fitting of tile is required in their installation. The

SPECIAL PORTS across back of boiler allow operation of air lance parallel to tubes, resulting in more effective cleaning

6 x 12-in. opening in the frame is closed with a removable 7½ x 13½-in. refractory-lined door held in place by crossbars bolted to studs in the frame. Set screws in the crossbars seat the door firmly in place. The accompanying illustration shows a typical installation. *ITEM 119*

Tighten Disconnecting Switch Contacts

WITH HEAVIER LOADS being carried on lines and buses good contacts in disconnecting switches are essential. Bad effects of contact heating on a disconnecting switch are progressive, since each period of heating relaxes a little more the pressure of the jaws on the blade. This is particularly true of older switches that do not include the improvements in contacts built into newer designs. The accompanying sketch shows how contacts of these older switches are being tightened. The spring is 2 in. long, cut from ⅛-in. spring brass strip, slightly tapered to the free end and formed in a simple vise jig. The springs are held on the studs by which the jaw base is attached to the support. They are easily applied to installed switches. *ITEM 120*



SPRINGS improve contact of switch jaws

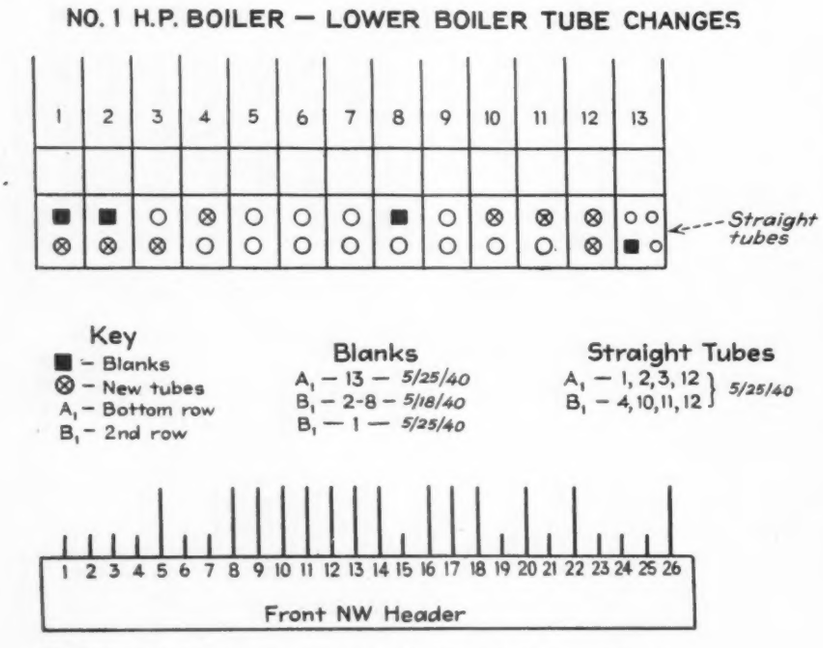
Special Measures Correct Tube Trouble

BOILER OUTAGE TIME, traceable to poor circulation in water screen tubes and resulting in destructive oxidation, has been reduced and the condition corrected by changes that increase the velocity of water flowing in the screen tubes at the plant of a Midwest light and power company.

To bring about the necessary increase in water velocity several of the tubes were removed entirely, thus increasing the circulation in the remaining tubes. Of the 26 tubes in the water screen about half, or thirteen in all, have either been blanked, welded to replace oxidized sections or entirely replaced by new tubes. Boiler in which changes were made operates at 650 lb. pressure, burning pulverized coal and oat hulls from an adjacent cereal mill.

The accompanying diagram shows the chart system used to record the position and status of screen tubes which have been altered due to oxidation.

Prior to the adoption of chemical treatment of make-up water at this plant in recent years an epidemic of blistering of boiler tubes also developed which was corrected by filtering, Zeolite softening and sulphuric acid addition for control of alkalinity to 35 ppm. Due to use of steam for industrial process the make-up at this plant constitutes from 50-70 percent of boiler water. Tube blisters were removed in this case by heating blistered areas and hammering the blisters down. *ITEM 121*


NO. 1 H.P. BOILER — LOWER BOILER TUBE CHANGES
1 2 3 4 5 6 7 8 9 10 11 12 13
Straight tubes
Key
■ – Blanks
⊗ – New tubes
A1 – Bottom row
B1 – 2nd row
Blanks
A1 – 13 – 5/25/40
B1 – 2-8 – 5/18/40
B1 – 1 – 5/25/40
Straight Tubes
A1 – 1, 2, 3, 12
B1 – 4, 10, 11, 12
5/25/40
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Front NW Header

RECORD of boiler tube changes and alterations kept in graphic form

Zoning of Customer Service Calls

REVISED PROCEDURE in the handling of customer service calls has been adopted by a West Coast company as one part of its contribution to the national war effort. A zone-dispatching system for service trucks to reduce the mileage covered and a reduction of service visits which could have been avoided by a clearer understanding of the "trouble" to be corrected are the two important modifications of former procedure.

Zone dispatching on a morning and afternoon schedule is aimed at eliminating "call-backs" and "no-work-done" reports. By telling the customer approximately when the service man will call, these wastes of time and mileage can be substantially reduced. However, specific appointments for service calls are not authorized except in emergencies.

Here are some of the specific provisions of the new wartime servicing code:

Service calls from commercial, industrial and agricultural customers reporting "no light" or "no power" may be accepted and service men dispatched, if necessary, at any time—night or day.

Domestic customer complaints of "no lights" will be serviced on a selective basis according to whether (a) it is a partial light outage on a branch circuit, or (b) lights are out *all over* the house. Employee receiving service request should ask some suitable question, for example: "Are lights out in only one or two rooms?"

If reply indicates a partial outage, the trouble is apparently a blown fuse on a branch circuit. Employee should then say, "Have you looked at the fuses? It is easy to replace them and you can get them at any neighborhood store."

Where lights are out in only one or two rooms, and customer is disinclined to try and replace fuse, we will accept service request, but inform customer our service man may not call until the following regular working day. Under the circumstances it should be satisfactory to defer action until our service man is next routed in the district. If service men are regularly employed for evening work, such service request may be dispatched providing it can be handled as routine work.

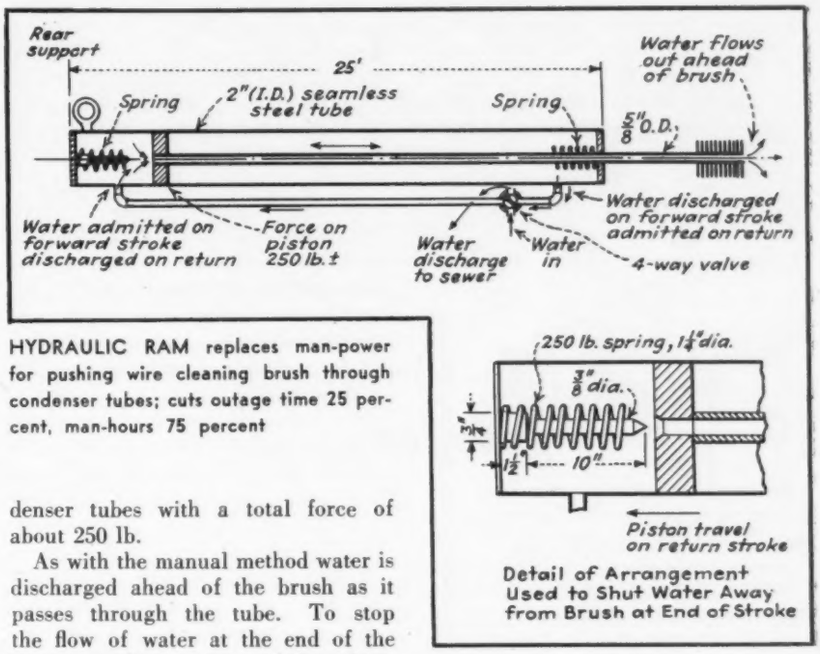
Since utility electric appliance service is limited to major cooking, water heating or heating equipment, ask the customer what type of appliance is to be serviced. Work that involves other appliances, such as refrigerators, washing machines, air-conditioning equipment, etc., should be referred to local dealers.

Upon request to service major electrical cooking, water heating or heating equipment, a suitable question should be asked to ascertain whether the appliance needs only minor repairs or adjustments. If, for example, a range switch needs repairs or one of the top units is burned out, these service requests will be deferred until the company's service man is next routed in the district. In some cases this may be the same day or it might be a few days later in portions of rural territory.

A notice to the customer will be left at the premises in all cases when the service man cannot get in on the first call.

Having left the post card, the service man should call back later in the day, provided other calls are being made near by and the call-back will not interfere with other work or cause overtime.

ITEM 122



HYDRAULIC RAM replaces man-power for pushing wire cleaning brush through condenser tubes; cuts outage time 25 percent, man-hours 75 percent

Hydraulic Ram Cleans Condenser Tubes Fast

CHANGE in equipment used to clean condenser tubes at the plant of a Central States utility has reduced turbine outage time 25 percent and man-hours required for the job 75 percent. Formerly, with wire brushes pushed through the tubes by hand, the job took twelve men 32 hours to finish. Now, with hydraulic ramming of tubes, the job is completed by four men in 24 hours.

Hard copper sulphite deposited on the inside of the more than 6,000 ⅞-in. tubes in a single condenser required that a wire brush be used in cleaning. This brush was formerly pushed through each 22-ft.-long tube on the end of a ¼-in. pipe 30-ft. long by four men. Two brushes were used with one relief crew of four men in attendance, so that each crew worked 40 and rested 20 minutes out of each hour. A stream of water was forced through the ramming tube and discharged ahead of the brush.

With the cleaning method now employed a hydraulic ram has replaced manual pushing of the brush. With the ram shown the brush now traverses a condenser tube and returns in seven seconds. Two rams are used to a condenser with two men in attendance on each ram.

The hydraulic rams were made in the plant shops using 2-in. (I.D.) seamless tubing as the cylinder. A double-acting piston actuated by water pressure under control of a four-way valve rams the brush rod through condenser tubes with a total force of about 250 lb.

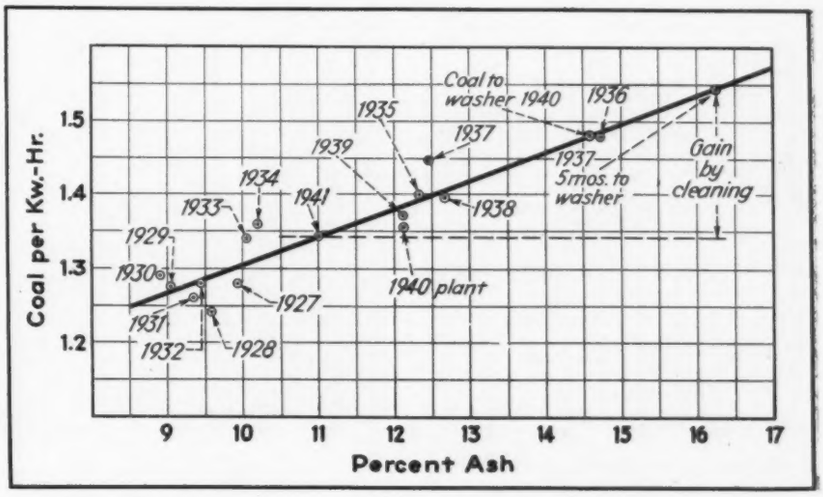
As with the manual method water is discharged ahead of the brush as it passes through the tube. To stop the flow of water at the end of the return stroke a stop rod has been added at the end of the cylinder which closes off the opening in the piston through which water enters the push rod. Springs at each end of the hydraulic cylinder cushion the piston at the end of its travel.

The ram is supported before the condenser tube sheet between a temporary boom at the forward end and a horizontal pipe supported by movable clamps on building columns at the rear. The ram is positioned horizontally by swinging the boom through an angle at the forward end and sliding the far end of the ram along the horizontal pipe. Vertical alignment is accomplished by raising and lowering the falls attached to the boom and by sliding the pipe clamps up and down.

ITEM 123

Coal Cleaning Saves Fuel, Boosts Output

ORIGINALLY installed two years ago in the interest of improving station economy, a coal cleaning plant is now proving its worth in enhancing the kilowatt capacity of boiler plant. This Middle Atlantic utility had been experiencing a steady increase in average ash content of all coal—purchased and company-mined. In 1929 the ash content was 9 percent and coal per



CLEANING OF COAL reverses upward trend of ash content of fired fuel and improves pound-per-kw.-hr. index

kw.-hr. 1.275 lb. For five months in 1937 ash had risen to 16¼ percent and economy had slipped to 1.54 lb. Installation of the cleaning equipment reduced the ash content of fired fuel to 11 percent and improved fuel economy to 1.34 lb. All this gain is attained despite the discarding of heavy-gravity roof-and-floor content that averages 8,000 B.t.u. per pound. *ITEM 124*

Report Forms Reviewed, Simplified, Eliminated

WHEN a four-man committee representing the statistical, accounting, rate and operating departments of a California power company finishes reviewing the monthly operating report of the company it will be considerably simplified, according to present plans. The studies were undertaken in an effort to conserve time and eliminate unessential records.

In a preliminary examination of the report it was found that some of the statistical information incorporated in it represented an accumulation of past requirements the reasons for which had disappeared. Other figures had been needed temporarily, but had been continued. Hence a decision was made to simplify the report to include only figures essential for Federal Power Commission, California Railroad Commission or company use.

The program will eliminate the need for several forms hitherto maintained by various departments and will save the time and effort of several employees in departments already shorthanded because of war man-power requirements. *ITEM 125*

Oil Rehabilitation Capacities Improved

LOAD-CARRYING CAPACITIES of all transformers are to be raised by an Eastern utility as a result of a comprehensive program of oil reclamation. Some 500,000 gal. is to be rehabilitated in the coming three years, using a recent design of Buckeye equipment. It is built for either portable or stationary application. Stocks of breaker and transformer oils will be treated first and then the oil in working equipment will be handled in the field in the case of power transformers. Idle tank trucks of local petroleum dealers will be used to transport the oil to and from test centers. Distribution transformer oil will be rehabilitated only as the transformers are brought in to the service stations. Large transformers (above 3,000 kva.) will be cleaned in place with dehydrated oil under pressure. Similar hot oil will be used for the coil-and-core cleaning at the treating station.

It is confidently believed that this systematic program will increase the load-carrying capacity as sludge accumulations are removed and sludge-free oil substituted. The operation requires only one man; four men will enable continuous operation in four rotating shifts per week.

Experience shows that the neutralization number of oil removed for rehabilitation runs around 0.8; after treatment it shows 0.003. The equipment handles about 60 gal. per minute of average fair oil and 45 g.p.m. of relatively bad oil. It is described as batch mix, power agitator, activated clay rerefinement; the light ends are distilled off by vacuum at low temperature. Reactivation of the clay is effected by heat. *ITEM 126*

Dynamic Fuel Control for Sudden Loads

TO IMPROVE station fuel economy in war-time and to provide more accurate fuel control to handle sudden loads on generators a utility company in New York State has installed automatic dynamic fuel control which provides a countless assortment of feed speeds.

The ordinary coal feeder operates on a start and stop basis to deliver the required volume of coal.

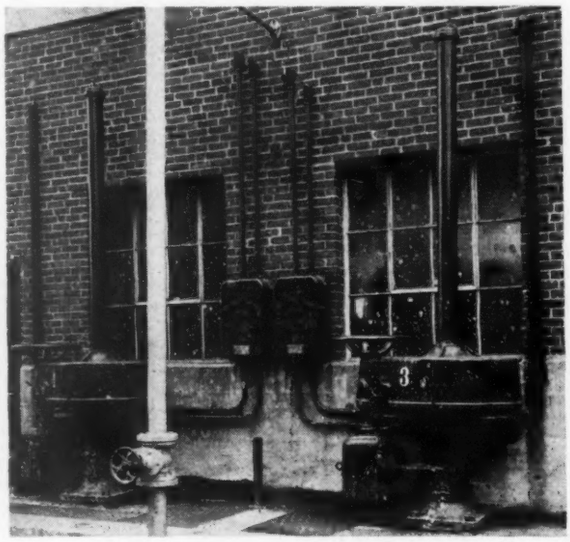
This Adjusto-speed motor, however, runs continuously as exact adjustment of speed from moment to moment over a 10 to 95 percent range is governed by the boiler demand. In this particular installation there are eight units, one operating on each coal feeder.

To increase boiler capacity from 275,000 to 300,000 lb. per hour this utility plans to install larger forced- and induced-draft fans and to revise tubes and downcomers. *ITEM 127*

Motor-Driven Gates Cut Operating Time

TO INSURE rapid opening and closing of the intake gates in the condensing water supply system of a power company under emergency conditions, as well as in connection with an annual overhaul of the tunnel intake, four Chapman valve motor drives were provided, with push-button control from within the screen house, so that the gates no longer need be manipulated by the tedious and wearing hand method previously employed. About two hours was formerly required to open or close the gates, and while the job normally came but once a year, present war conditions make it imperative to avoid every possible bottleneck in generation.

The screen house, located on the water front, is divided into two symmetrical sections, each equipped with four 7x7-ft. cast-iron gates weighing about 3.5 tons each and running up and down for about 7 ft. 6 in. By closing either pair, half the intake can be freed for maintenance. In operation the last 5 percent of the gate travel is made by hand manipulation, as stops are provided to open the motor circuits in time to prevent causing an impact of the gate against the screen well structure bottom. The gate stems are of brass, inclosed in pipes, as shown,



HALF of screen house installation, equipped with motor-operated intake gates which can be closed or opened in eight minutes, against two hours formerly required by hand operation

for weather protection. Three-phase, 550-volt induction motors of about 3 hp. rating drive the gate gearing; contactor boxes are located on the outer wall between the drives (thermal relays are used), and locked type push buttons are installed inside the house to prevent unauthorized operation. *ITEM 128*

Housecleaning in Reports and Records

MAINLY because of man-power and time shortages, and to save paper too, numerous utilities are giving intensive thought to reduction of reports and records. Many of these are simply recapitulations and often re-recapitulations of information and data that are really necessary at the places of origin and that can readily be found there by anyone interested. It was nice, and sometimes it was useful, in easier times for the supervisor periodically to assemble and transmit an operations report to the department head, who then wrote another report on the same operations and sent it to the vice-president in charge. But this flow of detailed information up to the top required a lot of pumping in terms of time and effort.

Indicative of what can be done in reducing this chore is the following list of reports eliminated and changed to longer periods in the sales operations of one power company. Of course a significant proportion, but not by any means all, of the reduction is attributable to the decline in sales activity:

Sales department monthly report to vice-president. (All of it except tabulated summary including comparisons with previous month and with same month in previous year.)

Sales Promotion Section:

Monthly letter to vice-president from sales promotion manager.

Monthly letters to sales promotion manager from division sales supervisors.

Lighting Sales Section:

Monthly letter to sales promotion manager from head of section.

Monthly letters to head of section from lighting salesmen.

Former weekly reports changed to monthly—

Commercial and residential lighting salesmen's reports and call cards.

Commercial and residential monthly work sheets. (These were tabulations of field reports with estimates of added load and revenue.)

Merchandise Sales Section:

Monthly letter to vice-president from sales promotion manager.

Monthly and annual reports of employee purchases of merchandise.

Monthly report of commercial sales by divisions.

Monthly merchandise inventory by makes of appliances and locations of stocks. (All this information readily available in operating stock records.)

Monthly report of kw.-hr. use per residential customer. (This was a duplication of data available in accounting department.)

Continuous graphic charts of energy use and merchandise sales per customer. (No point to this under present conditions.)

This utility is now making studies of reports and records in other departments and expects that comparable reductions in compilations of data and in writing of reports will result. *ITEM 129*

HOW problems of depleted personnel are being met

Safeguards High-Potential Meter Tests by Women

HIGH-POTENTIAL insulation tests of all meters are part of the shop test procedure of a prominent Eastern utility. Careful design of the apparatus used in making such tests has reduced the hazards of handling high voltage to an absolute minimum. Tests by a women employee can be made as safely as by men—a valuable consideration at all times, but especially so under present conditions.

Circuit diagram of the "high-pot" test set and its application in making insulation tests on a.c. meters are shown in the accompanying illustrations. The operator's left hand is pushing upward on the handle of a double-pole switch which closes the primary circuit of the step-up transformer. If the handle is released the force of gravity will open the switch. The insulated test probe held in the right hand is in contact with one of the meter terminals and 1,150 volts a.c. is being applied between one of the current coils and the meter base, which rests on a grounded zinc bench top. In case of an insulation breakdown, an indication is given by the neon lamp. The need for the operator widely to separate both hands in making the test eliminates to a maximum extent the possibility of making a personal contact with the high-voltage circuit. The gravity type switch is a main feature of this installation, since it immediately opens the step-up transformer's primary circuit if the switch is released.

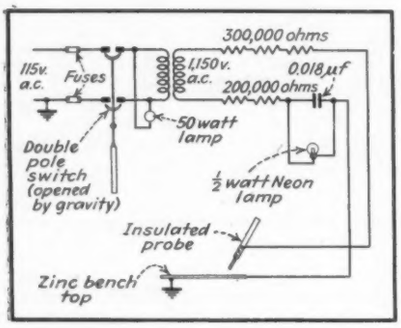
A similar high-voltage set being used to test the current coil insulation of a d.c. meter is also shown. The electrical design is the same as above, but there are slight mechanical differences. The double-pole switch in this case is operated by the tester's

OPERATOR testing a.c. meter insulation between current coil and grounded base

SIMILAR high-voltage test of current coil insulation of a d.c. meter

finger and requires considerable force to be held in the "on" position. An angle-iron running along the upraised back of the bench serves as the grounded electrode in place of the zinc bench top mentioned above.

The base of the d.c. meter rests against the grounded angle iron, and as the meter is in an inclined position



WIRING DIAGRAM of "high-pot" test installation

the brushes are caused to rest against the commutator, thus assuring a continuous potential circuit through the meter armature. Flexible leads (one attached to the frame of the meter) also serve as grounded electrodes. This particular test set contains all the safety features of the previously described set and in addition is relatively compact in design. *ITEM 130*

How It Started

SEVERAL MONTHS AGO a young lady applied for a position as stenographer with a Southern power company. No such place was open at the moment, but there was a temporary job in the drafting department—tinting a large number of photostatic map copies with water colors. Would the young lady like to try it? She would. She did a neat and workmanlike job on the maps. She discovered she liked that kind of work and asked if she could try her hand at tracing when the maps were finished. It was apparent that she had a natural knack with a ruling pen and soon she was making very good tracings. If one girl could do that work, why couldn't others do it, too? The fact that others can is attested by the presence of four more young ladies now turning out excellent tracings in the drafting room of the company.

And not only tracing. In a district office of the company there was another girl working as an operator of mechanical accounting machines. She knew how to use a screwdriver and could handle a pair of pliers without pinching her fingers. She liked to work with tools. When one of the billing machines got out of kilter she usually had it fixed before the repair man arrived. She thought she could test a meter as well as any man and she asked for a chance to try. Now she is working at a board testing single-phase meters, doing a good job and probably itching to get an opportunity to show what she can do in polyphase and demand meter testing. *ITEM 131*

Gets Reserve Man-power Through Flexibility

FLEXIBILITY in departmental organization at the operating center, and the full use of clerical help which ordinarily would be idle in routine operation, has helped one company to maintain economy and efficiency in meeting man-power problems.

Most of the divisions of the operating department have a minimum working force which is adequate for normal conditions. In emergencies, when these divisions have urgent but temporary need for additional employees, the latter can be drawn immediately from a few other divisions which, by the nature of their work, can defer some of their activities until circumstances permit resumption.

For example, the general shop repair division provides the extra help needed occasionally in the appliance repair division, and the line division stands ready to supply additional man-power promptly to the connection and trouble divisions in the event of unforeseen employee absences or temporary increases in work. Thus reserve man-power is maintained constantly in a few departments where it can be employed advantageously in normal operations, and periodic departmental surveys are made to accomplish better work distribution and practice within the divisions.

Night clerks in the service department who, except in the infrequent emergencies, would normally have considerable idle time have taken up clerical assignments formerly performed by the day force. The night men have learned to typewrite and now make complete street-lighting reports and other records and transfer reports from field copies to the office copies of registered order numbers.

Women Operators and Meter Readers

EXPERIMENTING with the extent to which women can take over duties hitherto performed by men, one Pacific Coal utility located in the heart of a war industry area which has seriously depleted its man-power not only has women meter readers but also is using women plant operators.

This company had used women meter readers in the last war, so that when it became evident that women must be drafted for some of the men's jobs, one woman immediately was placed on meter routes in one of the larger communities served. Her dress was of her own selection—conventional blue jeans and a leather jacket. Success with this one trial has led to the selection of other women for training.

At some semi-automatic hydro-electric plants experiments have been made with using wives of the operators as assistant operators or relief operators. Also wives of combination patrolmen-substation attendants have taken over the job of operating the substation, performing the usual switching operations without difficulty. Both of these experiments have been so successful that they indicate definite possibilities for wider use of women for this work. *ITEM 132*

Make Meter Readers From Bill Deliverers

A WELL-SELECTED STAFF of bill deliverers has been found by a Middle West power company to be an excellent source of man-power supply for meter reading. When men are hired to deliver bills, their possibilities for meter reading later are considered. Such employees understand that they may be advanced to meter reading jobs as the latter become vacant, and this tends to hold their interest and to induce their familiarizing themselves with the meter routes so that they can readily start reading. *ITEM 133*

Training a Reserve Operating Force

IN ORDER to provide a war-time emergency operating staff, classes are being carried on in the various plants of an Eastern utility for the training of office employees in operating duties.

Enrollment is entirely voluntary.

Trainees enroll for a ten-week course, consisting of two eight-hour shifts each weekend. They are assigned to such operating positions as oiler in steam station, dryer man in mill house, governor floorman in hydraulic operation and machine man in electric operation of station switchboards. In addition to carrying out regular shift work, these men are instructed and examined in their duties by the regular operating employees.

The highest spirit of cooperation has been evidenced in this work. Office employees welcome the opportunity to obtain insight into the actual operating problems of the station and similarly the operating force seem glad to learn the engineering viewpoint of their office associates. *ITEM 134*

Man-power Survey for Trained Personnel

SOME OF THE TECHNIQUE of the selective service program is being applied to internal personnel activities of a West Coast company to meet the changing man-power requirements brought about by the war. Inventories of draft eligible employees, of potential job requirements, special employee aptitudes and rated candidates for supervisorial positions have been initiated and combined into a streamlined program aimed at keeping a trained and efficient organiation on the job.

An inventory of men subject to the draft and those liable for call because of reserve commissions has been expanded to include those registered in the 20-44 year category. In this manner replacements may be planned for those liable for the draft. A survey of each district office has been made to determine jobs for which personnel would be needed in the future and also to determine the individual aptitudes and skills of employees for jobs other than those they are performing. This has permitted the personnel department to anticipate particular requirements and also to locate immediately employees whose special skills would fit them to perform jobs higher than those then occupied. An active program of rating employees who will become candidates for supervisors is providing a constant record of qualifications of those suited for advancement.

Most recent move to keep up with the labor supply program has been the initiation of two new forms by which company divisions or departments (1) indicate an immediate job to be filled or (2) indicate an employee whose job has been changed and who thus is available for transfer to another job. Since January 1 the personnel department has been making monthly reports to division managers on the number of people employed, resigned and laid off in an effort to emphasize the importance of keeping labor turnover to the lowest point. *ITEM 135*

HOW utility plant is being protected and blacked out

New Ideas for Plant Protection

TECHNIQUES for protection of generating stations have undergone rapid changes since December 7, according to the superintendent of a large generating station on the Atlantic coast.

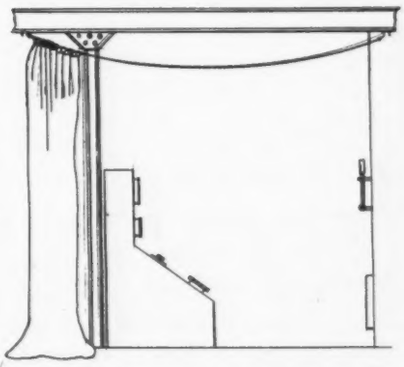
After dashing all over the station in mid-December, applying black paint to every piece of window glass, one of the men suggested an objective analysis of the station, one that would make the gloomy appearance unnecessary and that might even improve the protection.

Surprising results were achieved, the plant superintendent says, when they made an analysis of station lighting circuits and found out how few needed to be turned on at all for the duration. This was the first lesson learned, and as a result many lights in all sections of the station were merely switched off and will be kept off until further notice.

Next it was found, he said, after a little time had been spent thinking about the results which were being aimed for, that there were after all only a few hazardous spots in the station that required any additional protection. These points were (1) a few internal plant areas, (2) the system operators' control room, (3) skylights located directly above generators, (4) the boiler control board.

After the unnecessary lighting circuits were cut off permanently a d.c. emergency lighting system was connected to the few remaining necessary circuits. Next the station crew got rid of the hurriedly installed blue lights, rigged up slides for tarpaulin curtains to cover one-third of the windows at night and is now gradually cleaning the black paint from the other two-thirds of the station's windows.

In the system operators' room the black paint was scrapped off the windows and they were equipped with hinged kraft board barriers which can be swung instantly into the window aperture.



BOMB-PROOFING and light-lock for this boiler room control board are provided respectively by steel flooring over the entire board and operators' working area and by tarpaulin curtains strung on a wire at each end of the control board

Skylights over the generators have been taken out and have been replaced by composition board, then a solid "floor" of an undisclosed thickness was built under the skylight openings.

Many of the former lights in the boiler room have been entirely eliminated and a light lock and steel ceiling have been constructed around and above the boiler room control board (see illustration).

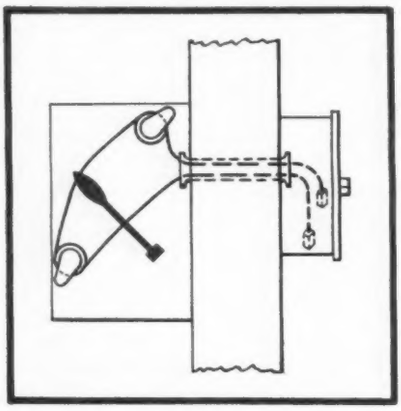
Supplementing these very recent innovations, this particular plant runs first-aid classes and fire drills, has set up stations for the men if air raids come and has the usual complement of high-pressure fire pumps, fog nozzles, axes and "Big Beam" portable spotlights at strategic locations.

If also has an unusually complete

and competent plant guard system, members of which are equipped with riot guns. *ITEM 136*

Steel Cable Saves Control Equipment

TO TURN OFF all the inside lights when the building is locked up was the problem confronting a Southern utility in regard to blackout require-



INDOOR switch operated outdoors

ments affecting the structure in which is housed its warehouse and service departments. Not a difficult problem for the technical brains of such an organization. Just put an electrically operated switch on the service and stick a push button anywhere convenient outside. That's probably how the job would have been done any time up to a year or so ago. The method shown in the accompanying sketch would have been too crude. But not today it isn't.

A hole was drilled through the building wall alongside the service-entrance switch. A pair of thin steel cables were run through the hole and fastened to the end of the switch handle, one cable going over an upper pulley and the other under a lower one. The cable ends were taped up into handles and inclosed in a box switch outside. By pulling one cable the switch is opened, is closed by the other. *ITEM 137*

Luminous Paint Helps in Power Plant Blackout

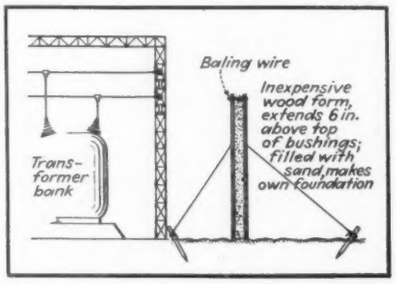
AN INSTANCE of the use of phosphorescent paint as an aid to operation of a power station in blackout is reported by a Southern utility. The paint is applied to hand wheels on governors, oil valves and other important control devices that must be manipulated in an emergency. As safety measures a band is painted on curbs surrounding floor openings, steps that might be dangerous in the dark are indicated, and shaft ends of rotating machines are painted. The effect is rather ghostly at first, but as soon as their eyes became dark-adapted the operators, familiar with their station, are able to "see" everything from the luminous indications. *ITEM 138*

Street-Lighting Styles Along New Jersey Shore

TO AVOID outlining ships near the coast against the background of shore illumination and thus to reduce chances of attack by enemy U-boats extensive revisions have been made to street lighting in shore communities. On double-unit standards along boardwalks the lamp on the seaward side is turned off. The landward light is on, but it is a lamp of much lower intensity than previously used. Also, the outer globe is painted black except for a narrow wedge on the land side. Boulevard lights with metal canopies are equipped with cylindrical hoods that allow light emission at the bottom, none sidewise. On urban "whiteway" lights the standard globes are removed and lamps of reduced intensity are used with socket extensions to permit the addition of a narrow cone metal shade to direct all light downward. *ITEM 139*

Barrier Makes Its Own Foundations

ONE Eastern utility has secured requisite plant protection at a minimum of expense. For barricades around substation transformers it built wooden

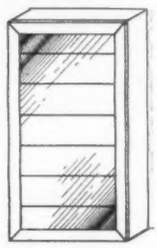

Baling wire
Inexpensive wood form, extends 6 in. above top of bushings; filled with sand, makes own foundation
Transformer bank

ADEQUATE anti-rifle bullet protection to outdoor transformers by means of wooden forms of cheap lumber filled with sand

forms, 1 ft. wide, tied together with bale wire and filled the forms with sand. Enough sand seeps out at the bottom to provide its own foundation, obviating the necessity for further foundation expense. *ITEM 140*

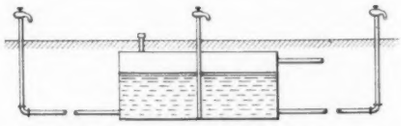
Flashlights Ready Where Needed

AT VARIOUS POINTS in its power plant a South Atlantic power company has fixed to the wall glass-front wooden boxes each containing seven flashlights in their cardboard cartons. When and if an air raid requires the plant to be operated in the sparse illumination of blackout lighting, there may arise an emergency condition in which light is needed quickly. Then the glass front box is broken and lights are at hand. *ITEM 141*



Substation Fire Protection

PROTECTION to electric service facilities against fire becomes a doubly important responsibility in war-time. In view of this the fire protection pro-



PRESSURE SYSTEM protects against fires where city water is not available

visions installed by a Middle Atlantic utility in substations where city water is not available should be of interest. As shown in the accompanying diagram, a 500-gal. tank is buried in the ground. Hose connections are made to 1½-in. risers from a 2-in. feed from the tank. The hoses are equipped with fog nozzles. The tank contains only 300 gal. of water, the rest of the space taken by air at 100-lb. pressure. Air pressure is maintained by an automatic compressor of the type used in filling stations for tire service. Although most effective against electrical equipment fires, the fog nozzles do not take a great deal of water and the quantities of compressed air and of water in the tank are sufficient to extinguish a pretty bad fire before pressure drops too low. *ITEM 142*

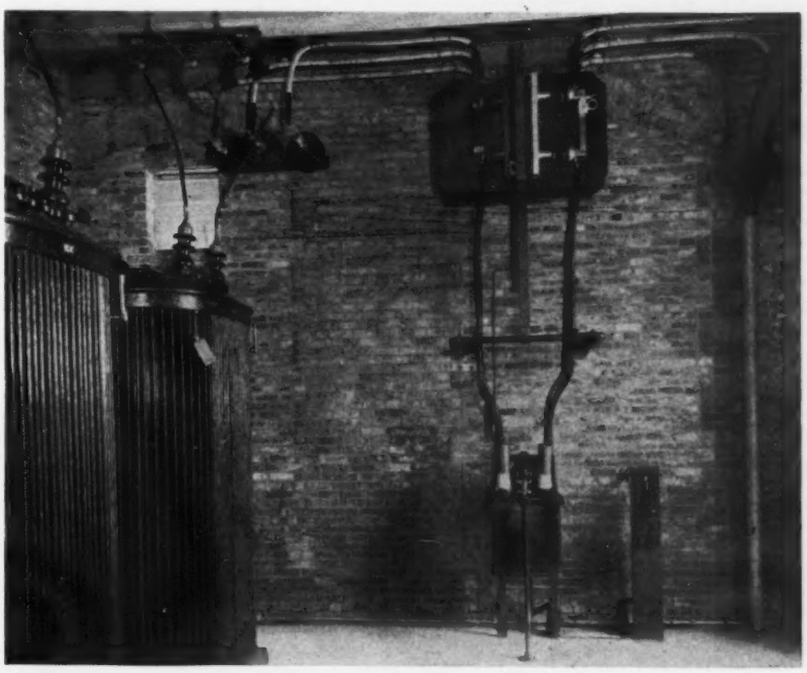
Building 1,500-Kva. "Sub" From Salvaged Material

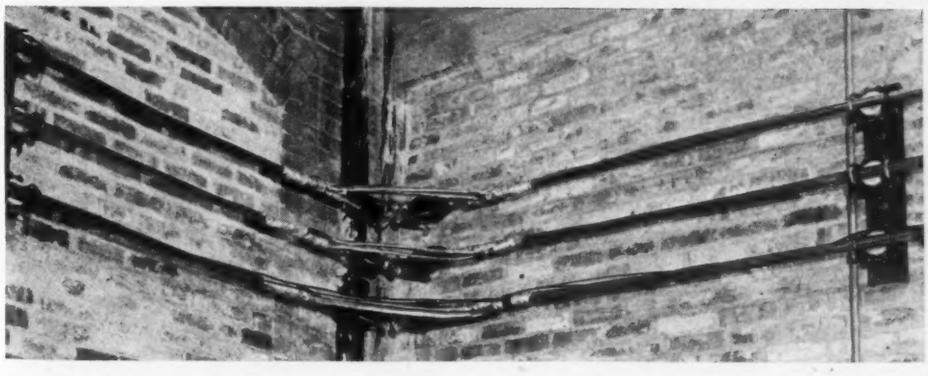
Three available transformers reconnected for 575-volt secondary — Secondary runs of salvaged cable conductors in multiple — Accessories collected from various sources

TO SUPPLY ENERGY to important war industries in short time without entering the equipment market the Cambridge (Mass.) Electric Light Company built a 1,500-kva. substation of the indoor type in one corner of a manufacturing establishment under occupancy for the above class of service and succeeded in putting the job through by using salvaged material, buying only a few connectors for the installation.

Three 500-kva. transformers previously used in supplying 2,300-volt energy to certain radial feeders were available on the system. These were already wound with 13.8-kv. primaries, and the secondaries were reconnected for 575 volts, with coils arranged so that if future conditions require it, these can be connected four in series to give 2,300 volts for low-tension feeder applications.

Charles T. Abbott, electrical engineer of the company, stated to a representative of the ELECTRICAL WORLD that the substation primaries were made up of No. 1 stranded bare tinned copper formerly used as single-phase secondary neutral. The 575-volt secondaries are made up from lengths of 300,000-cir.mil, lead-covered, paper-insulated cable which had failed under water conditions, each phase being composed of three 300,000-cir.mil conductors in the new set-up. The old cable was stripped of insulation and is carried on bus type insulators taken from another station and supported against the walls by 2.5-in. steel channels. Primaries are supported by two-disk strain insulators obtained from an affiliated property. Clevises and disconnecting switches were also taken from the system's overhead lines, and the main circuit breaker, now non-automatic, was removed from a site where its rupturing capacity had become inadequate for the loads transmitted. Fuse protection was obtained from an old substation which had been rebuilt several years ago. A ground bus was made up from sections of a 300,000-cir.mil bare single-phase secondary neutral wire. Existing steel beams were concrete-encased.





CONNECTIONS between incoming cable and transformer bank: a few Burndy connectors constituted the only newly purchased material for the complete installation

← ARRANGEMENT of 575-volt secondary buses, with temporary leads for station lighting service running along bottom phase conductor

Editorials

S. B. WILLIAMS, *Editor*

Expansion Curtailment

THE DECISION to curtail sharply the delivery of steam turbines in 1943, coming on top of repeated warnings of impending power shortages, doesn't make sense if taken entirely by itself. Couple it, however, with the conclusion that maximum use of materials can be made if instead of building more new war factories we convert already-built factories, it becomes apparent that expansion is becoming less a problem of kilowatts than it is kilowatt-hours.

It can safely be said that WPB would never sanction such a move were it not convinced that the war needs would be amply taken care of with very little if any disturbance to the residential users. There may be some curtailment of less essential uses, and then only when an emergency arises. This, of course, is in areas not already under Army regulations.

In the meantime, however, the industry is providing additional capacity that does not show up in the statistical reports of available kilowatts. By slight changes, some of which are reported in this issue, units are being uprated. Equipment is being pushed harder and is found capable of carrying greater loads than the nameplate rating. Losses are being reduced and power factors of lines are being improved. Interconnection is better distributing available capacity.

The new capacity, both steam and hydro, to be placed in service this year will be close to three million kilowatts and will be available to handle the December peak. For next year, not counting the carryover of delayed orders from this year, the estimated new capacity was almost three and a half million kilowatts. How much this will be cut is not known, but if the cut in March of 290,000 kw. was "modest," then it doesn't take much imagination to figure out what "slash" might be.

Last year the average output per kilowatt of rated capacity was 3,900 hours. This year it will go higher, probably over 4,100 hours, but with better water conditions prevailing this year and with the speeding up of Grand Coulee, it can be expected that hydro will carry a bigger part of this increase than steam. This longer-hour use of steam coming on top of 3,700 hours per kilowatt average last year, of course, creates a maintenance problem, but this is recognized so that the hazard to service continuity is minimized.

While the industry naturally would prefer to work with the safer margin that additional capacity would provide, it should recognize that this WPB action is perhaps the finest tribute it could receive. The industry supplying the most essential raw material to production had planned well enough to be excused from further large-scale expansion.

Regulation by Default

BLOCKED by the lack of market for utility equity issues, SEC is seeking another method to release operating properties from holding company control. Through enforced reorganization of the financial set-up of operating properties to reallocate the voting control the commission expects to put the squeeze on the parent companies.

Since the registration decision there has been no legal determination of the authority of SEC in its enforcement of the Holding Company Act. One thing after another has been permitted by default, until now the commission confidently believes that it will not be opposed seriously by the holding companies in anything it proposes.

The staff of SEC may be right in its belief that the act gives it authority to do the many things it is doing or is about to do, but are there not some advantages in having these rights rest on something more authoritative than the opinion of staff members? It is recognized that the Supreme Court is most sympathetic to the social, political and economic philosophies of the Administration, but little, if anything, is being gained by the present tactics except delay, and as time goes on the value of that is less apparent.

There is something permanent and definite in regulation by legal determination, but regulation by default simply leads to more and more encroachment on corporate and personal rights.

Utilization Voltages Anchored

EDISON BEGAN with a 100-volt objective, but the normal delivered voltage soon moved to 110. Factors since then have advanced it to something like 118 for a rough national average with a spread in practice that should somehow be limited. Agreement has now been reached in the E.E.I. engineering committees to accomplish initial steps in this direction, for the present only for single-phase voltages. Evidently upon the threshold of solution, therefore, is the standardization of utilization voltages and the associated service voltages.

That will mean that producers of utilization equipment will have a uniform basis for design. Quality of performance and expected life of motors, radios, ranges, table appliances, industrial heaters, control devices, lamps should be bettered. With those gains should grow the customer satisfaction in his relations with dealers, utilities and manufacturers, for better correlation of the voltage designs of these devices with a restricted spread of applied voltage should remove the inconsistent ratings of different equipments from different channels but sup-

plied by the same electric distribution. Many manufacturers of these equipments, particularly the smaller items, have apparently not appreciated the width of spread of operating voltages over which their products have to operate in the hands of the users.

No less a gain can ensue in the field of equipments applied wholly on the utility distribution systems. Substation transformers, regulators, capacitors, etc., would have a more positive basis for systematic ratios and optimum design characteristics. Losses, heating, magnetizing currents and overload margins can all be most favorably coordinated if the nation-wide voltages are held to a logical pattern. Lack of such service-entrance and utilization voltage coordination results in transformers operating at high densities, regulators effective over but a portion of their useful range and capacitors at times defeating their own purposes. Sooner or later the generator and the transmission substation could profitably be brought into the same mosaic. In fact, some of the chaos has come about because these elements of the electric system tended to fix the delivered voltage rather than *vice versa*.

This has been a prosaic exploration on the part of J. H. Foote and his collaborators. What it has lacked in glamour will be offset by the quiet benefits attained when production of utilization equipment and load cultivation are resumed. The present hiatus is an ideal time to institute the reforms, and all interested should find the time to study both the possible handicaps and the much more probable gains from orderliness in the scheme of things voltage-wise.

Smart Planning

GREAT CREDIT is due every branch of the electrical industry for the manner in which it has accepted the wartime restrictions of essential materials. At no time have these limitations been taken as a convenient excuse to give poorer service to customers. An excellent example of this spirit is found in the geared-to-the-war program of the National Adequate Wiring Bureau.

With all residential remodeling limited and all new residential construction banned, other than defense worker housing projects and in these a much restricted wiring, one's first thought would be that adequate wiring was a war casualty. Instead the bureau has embarked on a double program—Victory wiring for new defense homes and a customer education program for those already wired homes.

In the victory wiring program every WPB regulation will be met, but the jobs will be laid out to give the family living in the home as nearly standard utilization service as possible. This will be done by planned runs, location of outlets and attention to circuit protection. In addition, provision will be made for the outlets needed for full adequacy, so that when the war is over they can be installed at a very minimum of labor cost.

The other program is one of educating the present home owner how to check his wiring so that he will save needless trouble calls. All the time the customer is learning how to get along with what he has with the least amount of trouble he is learning the real benefits of adequate wiring.

These two programs won't bring any more money to the contractors, suppliers or utilities during the war, but they will give the customer a much better service than the limitation orders would indicate—and after the war they will be first-class prospects for modern wiring. Smart thinking and planning!

Going After Lightning at the Source

FRANKLIN sent his kite up to draw lightning right out of the clouds and studies have been made in the Alps, where the peaks graze and part the clouds. Now Professor Bryant and his associates at the University of Minnesota have used a commercial plane to beard Jove in his lair. What they have learned should, when expressed quantitatively as well as qualitatively, add much to the fruits of the many intervening studies conducted on surface structures and in man-made-lightning laboratories.

There is nothing quite equal to going after something at its source—our flyers just recently checked a lava flow by bombing the crater of an Hawaiian volcano. Our flying-explorers can likewise lay the foundation for checking the ravages of lightning if they find out how accurate the Simpson theory of charge formation really is and what quantities are involved in the initiation of a flash to earth.

Certainly more vivid and perhaps more persuasive than crest ammeter links and even oscillograms or klydonograph records are the pit marks on the three blades of a propeller that plowed through the potential differences of a charged cloud. The resulting craters give mute evidence of multiple strokes and of metal-melting amperes. Cruising at 190 miles per hour at 11,000 feet with blades "revving" at 1,200, the pittings occurred in well-defined arcs at intervals corresponding to somewhat less than 100 microseconds between consecutive discharges, with somewhat more severe burning at the trailing edges of the blades because of the lingering tendency of the parting arc.

Another record left by the impulse currents was the magnetization of a steel retaining ring about the neck of each aluminum blade—a built-in crest ammeter to get the peak of accumulated amperes along the axis of the blade. Particularly significant in the conclusions expressed in the technical bulletin is the fact that the propeller is predominantly positive to the cloud.

The experiments will be simulated in the laboratory, but the romance nevertheless will reside in the phase where lightning was sampled in its own habitat, before it ever got started earthward. One expects that both areas of observation will add still more to the fund of knowledge which, for electric systems, has pretty well tamed lightning's disposition to impair service.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Correspondent

Sharp Curtailment for New 1943 Power Plant

CURTAILMENT in the amount of power plant expansion which will be permitted is an integral part of the War Production Board's decision to apply the brakes to further war plant construction. There will be no "shut off" date for utility construction, but utilities will have to revise their estimates upward of what can be done with the equipment they have.

The roughly 2,000,000 kw. of steam and nearly another million kilowatts of hydro generating equipment allocated for delivery to utilities this year are not affected. It's too late to halt or materially alter fabrication of these units without terrific waste. Anyway, this capacity already has been earmarked for war loads which are on the way.

In 1943, however, generating installations will be sharply scaled down, despite the fact that orders on manufacturers' books today calling for delivery next year considerably exceed the 1942 allocations. It is too early to try to calculate this decrease in definite terms, but a WPB power branch official close to the capacity program feels it will be substantial.

Pooling to Help

The recent California power pooling arrangement alone eliminated 185,000 kw. from the 1943 list, at a substitute cost in materials of one new transmission line and some frequency equipment. More arrangements of that nature can be expected in other parts of the country. The power branch will welcome voluntary plans designed to do more with less, but the staff is taking the initiative without waiting for utilities.

In other fields of utility construction, where the fabrication period is shorter, the effects of this tightening up is even more apparent. As examples, take the power branch's reversal of its previous recommendations on both the New York state transmission line and the proposed tie linking the surplus capacity in Kansas with the Southwest power pool being set up primarily to serve the Lake Catherine aluminum plant. This latter project was stopped even after work had begun, so that materials could be "stockpiled" until a more essential use is found.

Simply to mention repairs and maintenance, for which utilities are becoming accustomed to the wartime requirement of living in part on inventory fat, is to cite another illlustration.

What does this sudden intensification add up to? Simply that Washington now sees the ceiling for the war production curve as within shotgun range, that the amount of war material from America's arms production plant as it is now scheduled to be operating next spring will require all the materials and the manpower there will be.

By arms production plant is meant the factories for making guns, planes, tanks and ships. Today huge quantities of raw materials and thousands of skilled workmen are being used to build more facilities.

Electric power, being a raw material in this picture, is subject to a somewhat different analysis—which explains why there can be no cut-off date for utility construction, as there can be for tanks. The question which remains now for the power branch to determine is the least amount of additional equipment which is required to supply the energy required for arms production at its peak level.

To determine that "least amount" involves eliminating from load unnecessary consumption, display and decorative lighting being conspicuous examples. It involves also the shifting of non-essential loads to off-peak periods when they can be handled. It involves requiring non-war loads to be serviced with reserve capacity—so long as that reserve capacity operates. It involves getting more kilowatt-hours out of each kilowatt of capacity.

These things are currently being studied by the power branch, and it is only after taking full effect of the possible savings that allocations of new equipment are being OK'd for installation beyond this year.

Even so, new generating equipment will be required in 1943 to meet the war loads and irreducible civilian consumption. What that consumption will figure out to is impossible to foretell now—current power branch figures will be revised by estimates of curtailable load now being prepared. Chairman Leland Olds of the Federal Power Commission has predicted that the arms program plus only essential civilian uses will require 300 billion kilowatt-hours in 1943, of which utilities will have to supply 253 billion kilowatt-hours—61 billion from hydro and 192 billion from steam.

Olds' Figures

Mr. Olds' figure is considered too high at the War Production Board, but not very much too high as a gross figure. Not even as much as 10 percent too high.

There is more variation between some of the components of the Olds and WPB calculations than between their totals. For example, given any kind of a decent break in weather conditions, hydro facilities are counted upon to produce a good bit more than 61 billion kilowatt-hours—which is but one-sixth more than 1941 hydro output. Hydro capacity will increase by that much, roughly speaking, so that the Olds figure contemplates virtually no improvement in kilowatt-hour production per kilowatt.

It may be stated that the WPB estimate of total requirement from utilities next year is something lower than that of Mr. Olds—so that the chairman's estimate of the required steam generation is too high by the margin of difference plus the underestimate of hydro output.

Regardless of how the hydro-steam division of load works out, it is apparent that the figures from which WPB is working anticipate a continuation and acceleration of the present production curve, while at the same time other forces are making new equipment harder to get.

NEWS OF THE WEEK

Refrigerator Stockpile Held to Essential Needs

600,000 new boxes, frozen by WPB, to be distributed in bulk lots where needed, according to new limitation order; little business for retail outlets indicated, but their stocks may be sold

The nation's stockpile of 600,000 new mechanical refrigerators, sale of which has been frozen by the War Production Board, are to be doled out to meet essential needs over the next two years as nearly as possible through normal commercial channels. Bulk of the sales, however, will be in quantity lots normally handled by manufacturers directly or by distributors. There will be little business for retail sales outlets.

Detailed procedure for allocating the "frozen" stocks is established in limitation order L-5-D, issued May 26, to become effective June 15. The plan applies to all stocks of mechanical refrigerators, gas, kerosene and electric, in inventories of manufacturers or distributors. The estimated 7,000–10,000 new electrical boxes still held by retailers may be sold without curbs, as may all used units. No other uncontrolled sales will be permitted.

The allocation plan established by the order permits the Army, Navy, Maritime Commission and Panama Canal authorities to make purchases on their own requisition and it is expected that some of these may be through retail dealers. All other sales will require a specific certificate of transfer issued by the Consumers Durable Goods branch of WPB—except sales by manufacturers to the Defense Supplies Corporation, an RFC subsidiary which has agreed to guarantee to purchase the entire stock of any producer so that the manufacturers may borrow bank funds against frozen inventories.

Certificates of transfer may be "cashed" by their holders with any distributor or dealer selling the brand specified, or direct with the manufacturer, but WPB made it plain that it expects most transactions to involve multiple unit sales normally handled on a direct factory basis or through distributors. It is also pointed out that the existing stockpile of 600,000 units will not be replenished, so that all trading in new units represents a dead-end business for the duration.

Prospective purchasers must apply for certificates of transfer on form PD-427, which is filed with the proper governmental agency—National Housing Agency for publicly owned war housing, the local FHA office for privately financed war housing, the U. S. Public Health Service for units intended for hospitals, doctors' offices, drug stores, etc., and the Board of Economic Warfare for all export sales, including Lend-Lease. These agencies pass on approved applications to WPB, as will the Treasury Procurement Division acting for any other government bureau.

The application form permits prospective purchasers to specify preference as to make and model, as well as size, etc. But WPB stated that it intends to see that all manufacturers' stocks are reduced at roughly the same rate. This will be done by altering the preferred make on some applications if necessary. Monthly reports are to be made showing the percentage of each brand of refrigerator shipped.

REFRIGERATOR OVENS MAKE WAY FOR WAR—Three Crosley officials watch the demolition of ovens, formerly used for dehydration of refrigerator parts, being moved for the installation of war machinery. Left to right: George E. Smith, vice-president; L. M. Krautter, advertising manager, and R. C. Cosgrove, vice-president and general manager

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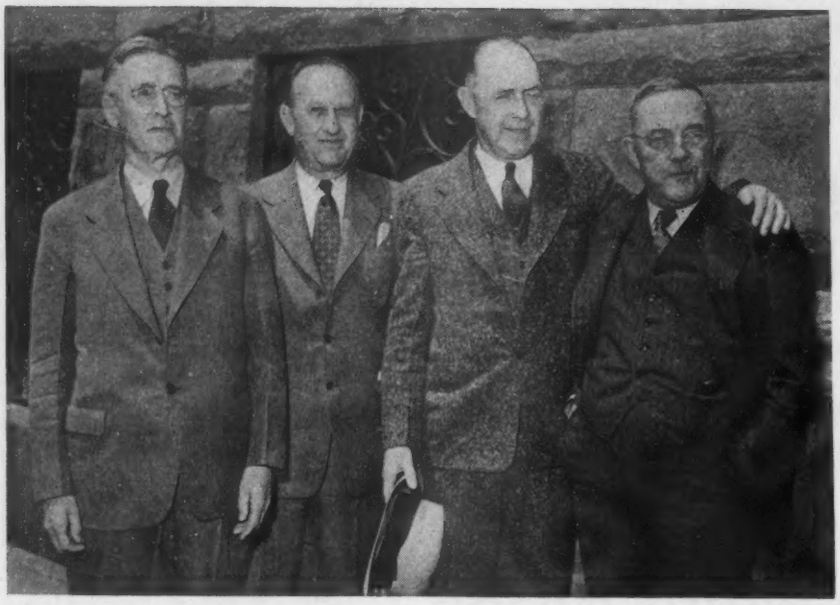
Laclede Customers to Pay Union Rates

If the purchase of Laclede Power & Light Co. by the Union Electric Co. is consummated, residential consumers of Laclede will pay between $66,000 and $99,000 a year more for current, it was disclosed last week by J. Wesley McAfee, Union Electric president. Laclede customers, in other words, would pay the same rates as Union Electric customers, Mr. McAfee said, but added that sufficient economies should result from the purchase to insure eventual reduction of residential rates to all consumers in the area.



FOUR R.M.E.L. CONFEREES—Four of the utility managers who attended the spring conference of the Rocky Mountain Electrical League's Utility Division, May 19, are seen, left to right: W. N. Clark, Southern Colorado Power; Arthur Prager, Albuquerque Gas & Electric; J. W. Alexander, Rawlins Electric and R.M.E.L. president, and A. E. Bradner, Las Vegas (N.M.) Light & Power

Post-War Council Aim of R.M.E.L Group

Creation of a post-war promotion council to devise ways and means for utilizing the electrical surplus, released from armament and ordinance production, into civilian consumer channels after the war was one of the accomplishments of the spring conference of the utility division of the Rocky Mountain Electrical League, held May 19 at Denver. Chairman of the new council is Guy W. Faller, president of Public Service Co. of Colorado.

Formation of the council followed a keynote address by J. W. Alexander, R.M.E.L president, in which he forecast that "bargain counter" power after the war would provide an alluring field for municipal ownership projects.

Col. H. S. Bennion, vice-president of the Edison Electric Institute, warned the thirty power executives gathered that personnel shortages might soon become even more critical than those affecting materials. He recommended serious consideration of woman-power to substitute for meter readers drafted for military service, consolidation of districts for billing purposes and the application of economies in the use of autos and trucks.

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PUD Ratifies New Rates

The Clark County PUD in the state of Washington has formally ratified a new Bonneville optional wholesale power rate schedule which has been in effect since January 1. The new schedule, known as "F-2," calls for reduction to a flat 1 mill per kilowatt-hour from the former 2½ mills of all energy purchased by the PUD over a 50 percent load factor.

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Take Fluorescent Fixtures Inventory

A nation-wide inventory of the existing stocks of fluorescent fixtures, sales of which are restricted to essential war jobs beginning June 1, has been started by the lighting fixtures section of WPB's building materials branch.

The section has prepared Form PD-499 to be filled out by all producers and distributors of fluorescent lighting equipment. The forms are scheduled to be mailed on or before June 5 and must show the number of complete fixtures, the number of separate ballasts and the number of replaceable starters on hand as of June 2, regardless of ownership. Any one with less than 25 fixtures, or 100 ballasts or 500 starters is not required to file a report.

Copies of the necessary form are available at WPB field offices or from the fixture section in Washington. Purpose of the inventory is to determine the number of "frozen" units existing throughout the country as a preliminary to working out a war policy for getting these fixtures to places requiring them to speed production.

NEWS BRIEFS

TO PERMIT WIRING OF NEW HOMES in the Pittsburgh area WPB officials told the Duquesne Light Co. recently that it is trying, through a utility-wide pool of copper wire, to get sufficient to permit connecting the homes.

THE PENNSYLVANIA COMMISSION HAS ORDERED Schuylkill County to pay Pennsylvania Power & Light Co. $2,026 as full compensation for property taken by reason of grade crossing improvements.

A NOTABLE SAFETY ACHIEVEMENT was recognized recently when awards were made to 57 Montreal Light, Heat & Power Consolidated chauffeurs by the Quebec Public Utilities Safety Association. Two chauffeurs who had perfect records from 1932 to 1941 inclusive won gold insignias. The utility's employees drive a minimum of 5,000 miles annually.

BONNEVILLE CAPACITY is now at 302,400 kw. with the installation of the sixth generator and completion of its test runs, the administration reports. Grand Coulee, with three large generators, is producing 324,000 kw.

HAROLD L. ICKES, Secretary of the Interior, has informed the Bonneville power administration that the War Damage Corporation will provide war risk insurance for the properties of the public utility district, municipal and cooperative power systems in the Pacific Northwest. To date, the War Damage Corporation has not been set up.

INDIANA PUBLIC SERVICE COMMISSION has begun a study of the possibility of reducing the number of meter readers for public utilities as a means of saving gasoline, tires and manpower. The question of permitting the customer to read his own meter from a card provided by the utility, with a regular check every three months, is being debated. Among the other possible remedies is the reading of meters every two months with an estimated bill sent every other month and the employing of women meter readers.

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Purcell Reappointed to SEC

Ganson Purcell, who was elected chairman of the Securities and Exchange Commission in January, succeeding Edward C. Eicher, has been reappointed to that post by President Roosevelt.

Be More Specific on Priorities, P.E.A. Told

More engineering information would aid WPB power group in passing on applications for new projects when materials are becoming increasingly critical; maintenance and salvage also under discussion at meeting

Fewer purchasing agent and vice-president visitors and more complete information by engineers in the initial application would greatly facilitate the task of the WPB power group staff in passing on priority and project submissions, P. B. Valle and C. C. Farrell of that staff told the transmission and distribution committee of the P.E.A. at Harrisburg last week. Assume that the reviewer knows nothing of the system, tell the whole story (the nature of the need, load data, shape of load curve, rating of existing equipment, voltage conditions, etc.) just as completely as a triply critical management would demand, was their advice. One item in a letter and all papers stapled together would also help the machinery in acting daily on 700 PD-1-A's and 200 utility projects; with 2,000-4,000 always in process. Nothing short of a breakdown or shutdown, actual or certain, rates as an emergency now. Too many trivialities are exaggerated; "last Tuesday it seemed as if every turbine and synchronous condenser had disintegrated."

Maintenance Programs Favored

Will granting a priority for replacement blading set a battleship back six weeks? Will absence of spares freeze a melting furnace or ruin an oil-still? Those are the questions uppermost, they said, for the ensuing six months when ravenous production industry will consume raw materials like never before and create stringencies that will make this spring look like abundance. They viewed planned preventive maintenance programs with favor.

Steel wire for line extensions entered the committee's deliberations actively and several mentioned ordering quantities, some up to 30,000 feet. It was not favored by some for three-phase primaries because of the impedance obstacle to further extensions. Potomac Edison will build a steel-wire line with doubled pole spacing, intervening poles to be inserted if copper replaces it later. Several are using steel or contemplating it for neutrals, but considerable uncertainty exists about the connections, clamps and tie wire practices.

Standards of construction are in eclipse, said J. G. Charest in enumerating many measures to extend equipment life; among them conversion of arc-lamp transformers to 6.6-amp. series service, trimming festoons off frayed wire with live-line tools and dipping 12-kv. locust pins with semi-conducting paint to stop digestion. P. H. Robbins mentioned welding copper-wire remnants with a 1,000-amp. 220/110/10-volt transformer, using phos-copper or sil-phos.

Philadelplia Electric salvages nuts by the Udilyte cadmium-plating process, has converted many obsolete static-wire bayonets to 33-kv. ridge pins, and uses Nicopress sleeve tool to extend leads on arresters with short ones. Scranton Electric is using Wallaba poles in lieu of steel for street lighting jobs. Potomac Edison has avoided 180 interruptions by successful use of pole-top, single-pole repeating oil circuit breakers on 41 installations.

Successful results with 500 combination fuses and gaps on 6.9 kv. is likely to extend the principle and application to 2.3 and 4 kv., said J. G. Charest (Pa. Power & Light); he also suggested a five-to six-year life of tubes on gapped arresters provided they are watched for deterioration. Ground wires are being partly insulated and used for telephone and obstruction lighting circuits on two systems; R. W. Mavity said Duquesne Light regularly insulates one overhead ground wire and uses it as a spare conductor.

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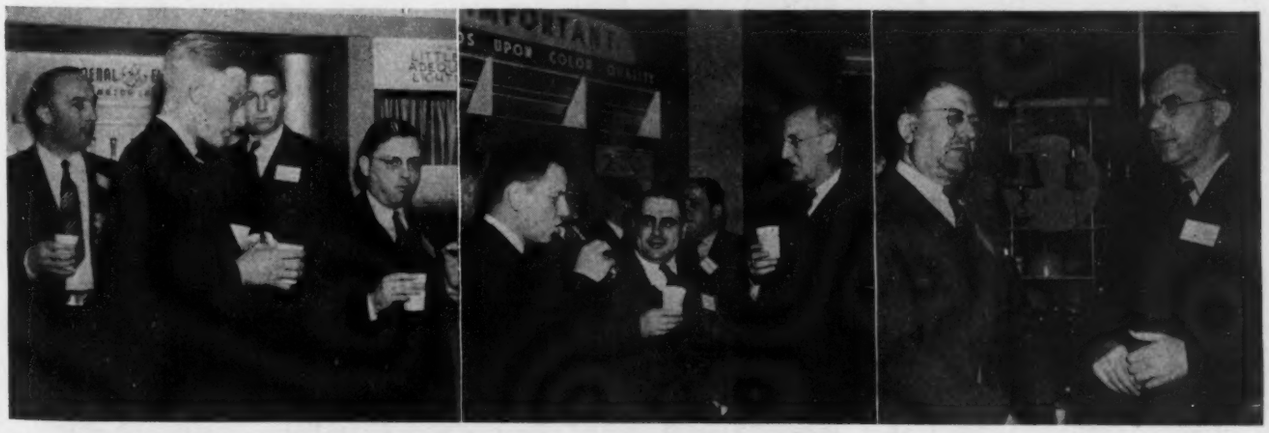
Wilkes Calls REA "Socialized Power"

The Rural Electrification Administration was formed for the purpose of "socializing the power industry, rather than to supply power to American farm homes," it was charged by Frank M. Wilkes, president of the Southwestern Gas & Electric Co., Shreveport, La., recently in an address before the 31st annual convention of the Arkansas Utilities Association at Hot Springs. Since April, 1941, he declared, not a single industry had located in Arkansas, war or private, on which the REA had not made a competitive bid to furnish power, although they were not equipped to deliver these services.

Other speakers on the program included S. C. Lynch, executive vice-president of the Arkansas Power &



THE PAUSE THAT REFRESHES AT NELA PARK—Close to 100 utility lighting directors attended a recent three-day conference on war-time lighting at G. E.'s Nela Park, Cleveland, recently. Seen, left, are F. M. Carley, D. & B. Gas & Electric, Danbury, Conn.; Frank Knowles, Pennsylvania Electric; Lucien Knight and Carmen Miller, Duquesne Light. Center, G. K. Hardacre, Public Service of Northern Illinois; R. B. Brown of Boston Edison and Art Oday of Nela Park. Right, Buford Martin of TVA at Chattanooga and H. H. Magsdick of Nela Park. The subject of blackouts received extensive treatment by L. C. Porter, Nela Park specialist

Light Co., who reported that designs for the $3,000,000 steam generating plant, to be built near Stamps, Ark., had been revised to make possible a saving of 600,000 pounds of steel. Ben E. Carter, former chairman of the Arkansas Utilities Commission, predicted a great power development program in the state after the war and warned delegates they could expect further government regulations of their rates and practices. Davis M. DeBard, vice-president of Stone & Webster Service Corp., showed movies of the London blitz bombings. Harold F. Smiddy of Ebasco Services, Inc., criticised government bureaucracy and dwelt at length upon the expansion of REA.

The following officers of the association were elected: President, A. B. Harper, president of the Fort Smith Gas Co.; first vice-president, S. C. Lynch, executive vice-president Arkansas Power & Light Co.; second vice-president, L. L. Baxter, vice-president Arkansas Western Gas Co.; secretary-treasurer R. E. Ritchie, Arkansas Power & Light Co.

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PUD Seeks to Buy Nebraska Power Co.

The Consumers Public Power District of Columbus, Neb., intends to try to buy the Nebraska Power Co., a subsidiary of American Power & Light and last remaining private utility in the state, according to a recent announcement by Charles B. Fricke, president of the PUD group. The district, Mr. Fricke said, is prepared to offer $42,700,000 for the Nebraska Power property.

Under public ownership, Mr. Fricke said in a letter to Mayor Butler of Omaha, Nebraska Power could be operated at a saving of $2,500,000 a year and would continue to pay taxes to city, county, schools and state. The district, Mr. Fricke added, would be willing to operate all the Nebraska Power Co.'s properties or turn over the lines in Omaha to the city at a price fixed by engineers, or enter into a management agreement with the Omaha Metropolitan Utilities District and turn over the Omaha property to the city for $1 when it has paid for itself out of earnings, or sell the property to a board of Omaha business men as trustees until a permanent arrangement was decided upon.

The publicly owned hydro-electric system now sells large amounts of power to Nebraska Power Co.," Mr. Fricke concluded. "Nebraska Power makes a profit on this power we sell. We do not feel it is proper that a private company should make a profit on power generated in a government-financed plant."

U. S. Requests Role in G.E. Patent Case

In a patent infringement suit brought against Hygrade Sylvania Corp. by General Electric Co. in federal court in New York, the anti-trust division of the U. S. Department of Justice has asked for permission to intervene on grounds that the plaintiff was using its patent relating to fluorescent equipment to restrain trade through license agreements which affect resale prices.

Judge Vincent L. Leibell, who has been hearing testimony in the infringement suit for three weeks, reserved decision.

Government counsel contended that through its license agreements General Electric was able to fix the quantity of fluorescent lamps manufactured and had achieved domination in the field through agreements with foreign companies regarding the import and export of fluorescent equipment.

Counsel for General Electric contended that an intervention would be "untimely" since the action had been in progress three weeks and that the present action would be held up for additional preparation of the case. The company also contended that under Federal rules of civil procedure, the Government did not have the right to intervene in a patent infringement action.

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Minneapolis Tackles Appliance Service Problem

The problem of maintaining appliance repair is receiving attention from two groups in Minneapolis.

A plan for promoting "Approved Service Shops," which will be submitted to all interested groups, has been prepared by the North Central Associated Electric Industries to help solve the problem of dependable customer service for the duration. In addition, a special committee is at work for the Minneapolis Electric Appliance Dealers Association on the problem of maintaining service. Dealers are agreed that service demands will be increased; that charging "service losses" to sales will be out, and that profitable service will enable many dealers to continue in business.

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A. W. Bureau Plugs "Victory Wiring"

A new war-time program—"Victory Wiring Systems for Defense Homes"—and a related "Check Your Wiring for Wartime Service" campaign were developed at a recent meeting of the plan committee of the National Adequate Wiring Bureau, under the chairmanship of C. M. Fife of West Penn Power Co.

A booklet has been prepared on the "Check Your Wiring" theme with factual, "how-to" information for consumers. This booklet may be used by utility representatives as a basis for personal contacts with customers or as a mailing piece. In addition, the plan committee has OK'd the outline of a "Manual of Consumer Information" on home wiring. This will review wiring standards, explanation of wartime restrictions on wiring in new and existing homes and the need for extra care in the use of electric service during war-time. Other sections deal with the effect inadequate wiring may have on appliance operation.

WARTIME WIRING POSTER—C. M. Fife, West Penn Power and plan committee chairman of NAWB, shows Herbert Metz, chairman of the executive committee, the new "Check Your Wiring for Wartime" poster

Senate Defers Action on Central Valley Plant

Appropriations committee agrees on need for new steam plant, but decides "competitive phases" of project be deferred for duration; votes sum to finance preliminary engineering work, however

The Senate appropriations committee this week expressed full agreement with Secretary Ickes' ambition to build another public power domain in Central Valley, California, but it decided that construction of the competitive phases of the project must be deferred during the war.

Instead of seeking funds for a competitive steam plant, Ickes was told by the committee that he and the Pacific Gas & Electric Co. should agree to pool all power resources so as to get the most energy to war industries in the least time and with the least use of materials. This can be done, the committee said, by feeding Central Valley energy into the utility lines at Oroville, Calif., with construction of only a comparatively short line.

Agree on Necessity for Plant

The committee proposed that any pooling contract linking the public and private generation should be "for the duration of the war and a reasonable time thereafter" and that it "should provide for the recapture, without projudice, of any advantages which temporarily may accrue to either party."

In enunciating this war-time policy, however, the committee made clear that it agreed with Ickes that a steam plant is necessary for development of the Central Valley project as intended by the original Congressional authorization. To make sure that this objective is not lost sight of in the war period, the committee voted an appropriation of $200,000 to finance preliminary engineering work on the steam plant—a proposed $20,000,000, 150,000-kw. station. It also restored to the Central Valley appropriation $3,723,000 cut out by the House to build transmission lines as may be permitted by WPB.

"The committee recognizes that the congressional policy respecting the Central Valley project was adopted during a period of profound peace and that our country is now engaged in a desperate struggle for its existence," the committee said. "Everything must yield to winning the war, but any action taken to insure victory should not be of a character which will prevent a prompt return to the power plan heretofore established for the Central Valley project."

Just how the Senate committee reached the conclusion that congressional policy heretofore contemplated a public power development from the Central Valley project was not made clear. Both this and last year, the House specifically rejected the idea of building a steam plant as part of this Reclamation Bureau project.

Coincident with the committee action, it was disclosed that WPB Chairman Nelson and WPB Power Chief J. A. Krug both told the committee that priorities could not be made available at this time for the steam project. The committee said the WPB officials agreed that such a firming up station is necessary to the "ultimate development" of the project.

With the engineering and line funds, the Senate appropriation for Central Valley is raised to $39,019,000 for the fiscal year beginning July 1. Other appropriations for power projects under Interior Department jurisdiction include $19,175,000 for Grand Coulee, $7,000,000 for the Colorado-Big Thompson project, $1,940,000 for Parker Dam, $4,000,000 for Davis Dam, $500,000 for Fort Peck transmission lines, $5,000,000 for Boulder Dam. Bonneville Power Administration is voted $21,864,000 for operating the Bonneville and Coulee power systems.

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Interprets Safety Equipment Order

Interpretation of safety equipment general limitation order L-114, issued by the WPB on May 5, restricting, among other things, manufacture of "personal" rubber protective equipment for linemen to gloves, overshoes, sleeves and blankets, was clarified recently, (5/12) in a letter by H. C. Mesch, chief of the Safety and Technical Equipment Branch, Industrial Safety Equipment Section, WPB, to a manufacturer of lineman's rubber protective equipment.

In his letter Mesch pointed out that order L-114 covered only "personal" protective equipment—that which linemen wear on their persons. Manufacture of other lineman's rubber protective equipment was, he indicated, governed by order M-15-B of April 1. That order permits manufacture of such items as rubber gloves, line hose, insulator hoods, blankets, cable end test caps and separators, cable bandages, linemen's rubber sleeves and insulating stools.

Omission of rubber line hose, insulator hoods, etc., from mention in order L-114, has led many safety directors to believe that this type of rubber protective equipment would no longer be available. Mr. Mesch's letter makes it clear that these items will still be produced under terms of order M-15-B.

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'Strong Utility Needed,' Says Campbell

Announcing a reduction of 16⅔ percent in its common stock quarterly dividend payable July 1, the Connecticut Light & Power Co. stressed through its president, C. L. Campbell, the heavy burdens of increasing costs and revealed that in the past five years the company's annual tax bill has risen from $1,718,000 to $3,725,000 as computed under the present law. The July 1 dividend, 62½ cents per share, will go to more than 19,600 common-stock holders, 10,625 of whom reside in Connecticut. Mr. Campbell further said that there is a probability that under the proposed 1942 tax law the company will have to pay $4,335,000 in taxes on this year's activities, and called attention to the fact that the cost of the 423,000 tons of coal used in generating electrical energy has increased from $4.86 to $8.08 per ton.

Speaking of pending tax legislation, Mr. Campbell said in part: "It is extremely unfortunate that some formula or plant has not been developed that is as fair to the public utility business as to other industries, so that it will not be badly handicapped. The C.L.&P. company is responsible for service to about 65 percent of the state's area and 41 percent of its population, and beyond this, to a large and important part of the war production program. Such a responsibility makes it necessary for the company to maintain a strong position so that it will be able to meet the war demands and still cope with the post-war problems, which will undoubtedly be serious. The management believes that the company must be prepared to aid in restoring normal conditions after the war in the communities to which it is responsible. It would be a very serious matter if this corporation were, through lack of sufficient revenue or as a result of excessive taxation, to be so weakened and crippled that it would be unable adequately and properly to carry on its functions."

WPB Training Plan Offsets Employee Loss

WPB's "training - within - industry" program is a partial solution to the loss-of-employee problem of the utilities, according to R. W. Peterson of the Puget Sound Power & Light Co. At Puget Power, Mr. Peterson said, 420 key men have already completed the course and 150 additional men are taking it. Job instructor training is the first step, Mr. Peterson reported, in a talk before the seventeenth annual meeting of the accounting and business practice sessions of the Northwest Electric Light and Power Association at Butte, Mont., May 21–22, 1942.

The fact that Pacific Northwest companies are losing many of their trained personnel to the armed forces, the shipyards, airplane plants and other war industries, emphasizes the importance of this scientific training technique in training men and women for technical utility jobs, Mr. Peterson said.

Quarterly Meter Readings

Rubber, gasoline and man-hours are saved, H. Mann of Utah Power & Light Co. told the convention, through the adoption of quarterly meter readings in rural areas. Other companies, it was reported, have been studying the possibilities of this practice and have considered applying it to urban residential accounts, too. A variation is the practice of estimating final residential bills which has been tried out by both Northwestern Electric and Portland General Electric in Portland, Ore., according to Ralph W. Lawlor of the former company and E. W. Bredemeier of the latter. Companies might look into the matter of meter reading on a six-month basis, Mr. Lawlor suggested.

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Liquidation of K-T Properties Proceeds

Following agreements reached last month for the sale of Kentucky-Tennessee Light & Power Co., an Associated Gas & Electric subsidiary, for a base price of about $7,000,000 (ELECTRICAL WORLD, April 25, page 8; May 16, page 60) Associated Electric has filed a new application with the SEC covering partial liquidation of the K-T properties, made necessary by its inability to find a purchaser of its entire interest in K-T.

One unit at Frankfort, Ky., is up for sale to a local syndicate, the Frankfort Utility Corp., but authorization for the deal has been withheld by the commission pending a hearing on rates. Announced purchase price for this unit is $1,350,000.

In order to dispose of the remaining assets, a new Kentucky corporation will be formed called the Tri-City Utilities Co., to which will be transferred such properties as K-T has not sold prior to June 1.

Five other western Kentucky cities, Bowling Green, Hopkinsville, Mayfield, Murray and Russellville, in cooperation with TVA and REA, have contracted to buy the respective local properties of K-T. Bond issues for the purchases have been sold to banking groups totaling $1,930,000, while an issue of $790,000 of Bowling Green bonds has not yet been awarded.

The creation of the Tri-City Utilities and the acquisition of properties by the new company, it was said, is designed merely to facilitate consummation of the agreement between Associated and TVA and will be dissolved after its function has been performed.

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SEC Hearings Postponed

Hearings on corporate simplification proceedings, involving the Republic Service Corp. and the General Gas & Electric Corp., have been postponed at the request of the companies. Republic's hearing was postponed from June 9 to July 15 and the time required to file an answer to SEC charges from May 25 to June 15. General Gas & Electric's hearing, scheduled for May 26, has been postponed indefinitely.

MEETINGS

Edison Electric Institute—Annual meeting Hotel Biltmore, New York, N. Y., June 11. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

American Society of Agricultural Engineers—Summer meeting, Milwaukee, Wis., June 29-July 1. Raymond Olney, secretary, Saint Joseph, Mich.

Previously Listed

American Society of Mechanical Engineers—Semi-annual meeting Statler Hotel, Cleveland, Ohio, June 8-10. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

Canadian Electrical Association—Annual convention, Seigniory Club, Que., June 11-12. B. C. Fairchild, secretary, 804 Tramways Bldg., Montreal, Que.

National District Heating Association—Annual meeting, Dayton Biltmore Hotel, Dayton, Ohio, June 11-12. John F. Collins, Jr., secretary-treasurer, 827 N. Euclid Ave., Pittsburgh, Pa.

Public Utilities Advertising Association—Annual convention, Hotel Commodore, New York, N. Y., June 21-23. E. N. Pope, secretary, Carolina Power & Light Co., Raleigh, N. C.

American Society for Testing Materials—Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 22-26. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

American Institute of Electrical Engineers—Summer meeting, Chicago, Ill., June 22-26. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

Society for the Promotion of Engineering Education—Annual meeting, Columbia University, New York, N. Y., June 29-July 2. F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa.

War Problems Occupy Southeast Conference

Small industrial customers are the backbone of the utility business and must not be neglected in favor of large, easy-to-get war business, Paul Vecker, vice-president Carolina Power & Light, told the Industrial Power Conference of the Southeastern Electric Exchange at Raleigh last week. Other conferees stressed this point but cited the difficulty they had getting war work for the small manufacturer.

A great many problems resulting from the war were discussed. High load factor business with low final steps was not considered desirous without an escalator clause when high cost standby or purchased power has to be used to supply it. No uniformity of rates for supplying war loads or amortizing costs of new construction was apparent. As a rule, the companies were not soliciting war loads from new customers, but were confining their efforts largely to helping present customers convert.

There was some confusion in interpretating of L-94 with respect to interconnecting with factory-operated plant. Though the companies generally had either completed their surveys or were well along, they did not know who would pay the cost of interconnection or whether materials would be available.

Post-war competition, particularly diesels and used equipment, came in for considerable discussion. It was agreed that the best way to meet it lay in working with customers and in training personnel. Some companies have already started this training.

•

Northeast Florida Power Emergency

A power emergency exists in the northeastern part of Florida, notably in Alachua, Bradford, Clay, Duval, Putnam and Union counties, according to the Federal Power Commission in an order authorizing temporary interconnection of facilities to bolster power supply in and around the cities of Jacksonville, Gainesville and Starke.

Interconnections and interchanges ordered are: (1) Directly between facilities of Florida Power & Light and Jacksonville municipal system; (2) directly between Florida Power and Gainesville municipal system, and (3) between Florida Power & Light and the city of Starke municipal facilities through a transmission line to be constructed by the Clay Electric Cooperative Association.

All the interconnections have been approved by WPB's Power Branch.

Power Output Shows Gain

Electrical energy distributed by the electric light and power industry for the week ended May 23 amounted to 3,379,985,000 kw.-hr., a gain of 11.2 percent over the corresponding week a year ago, according to the Edison Electric Institute. The increase over the previous week's figures of 3,356,921,000 kw.-hr. was seasonal in character.

Only two of the seven geographic regions in the country contributed to the increase—New England, which showed a 0.3 percent gain over the May 16 figures, and the Rocky Mountain region, where the increase over last year's corresponding week jumped from 2.5 percent for the week of May 16 to 4.6 percent for week of May 23.

EDITOR—*The output curve shown on the chart for the past two weeks, through an error in calculation, showed a decline. The accompanying chart has been brought up to date, with curve correctly shown.*

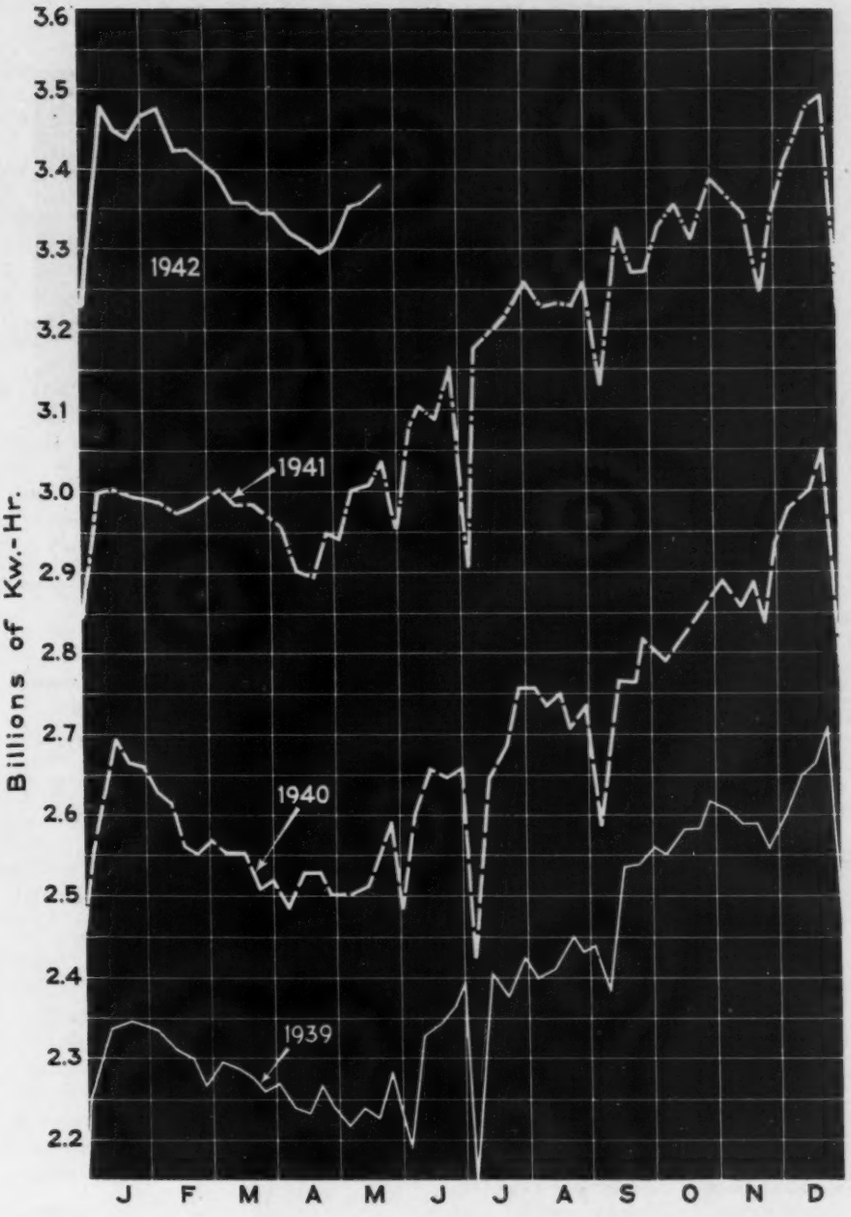
Weekly Output, Millions Kw.-Hr.

1942		1941		1940	
May 23	3,379	May 24	3,040	May 25	2,588
May 16	3,357	May 17	3,011	May 18	2,550
May 9	3,365*	May 10	3,003	May 11	2,515
May 2	3,304	May 3	2,944	May 4	2,503
Apr. 25	3,273*	Apr. 26	2,950	Apr. 27	2,499
Apr. 18	3,308	Apr. 19	2,897	Apr. 20	2,529
Apr. 11	3,321	Apr. 12	2,906	Apr. 13	2,530
Apr. 4	3,349	Apr. 5	2,960	Apr. 6	2,494
Mar. 28	3,346	Mar. 29	2,975	Mar. 30	2,524
Mar. 21	3,357	Mar. 22	2,983	Mar. 23	2,508

Percent Change from Previous Year

	Week Ending		
	May 23	May 16	May 9
New England	+ 9.0	+ 8.7	+ 7.8
Mid-Atlantic	+ 8.2	+ 8.4	+ 8.7
Central Industrial	+ 9.0	+ 9.3	+10.2
West Central	+ 8.2	+ 8.2	+10.1
Southern States	+15.4	+16.7	+17.0*
Rocky Mountain	+ 4.6	+ 2.5	+ 3.3
Pacific Coast	+19.2	+19.6	+20.1
Total United States	+11.2	+11.5	+12.0*

*Revised figure.



OCD to Coordinate Sabotage Protection

The President's executive order assigning the Office of Civilian Defense to coordinate programs for sabotage protection of the nation's essential facilities is considered largely a formalization of an existing procedure in so far as electric utilities are concerned.

OCD Director Landis has stated his intention of leaving to agencies which have been directing sabotage protection in particular fields the job of continuing that work. The Federal Power Commission, by virtue of the President's June 14, 1940, directive, administers the governmental sabotage program for electric utilities.

The executive order definitely adds gas utilities to the FPC jurisdiction—the agency has been at work in this field and it expects soon to obtain OCD approval of its proposed protective steps for gas utilities. Because FPC has long been working with OCD on electric utility measures it is not expected that any formal approval of the FPC's plan will be needed.

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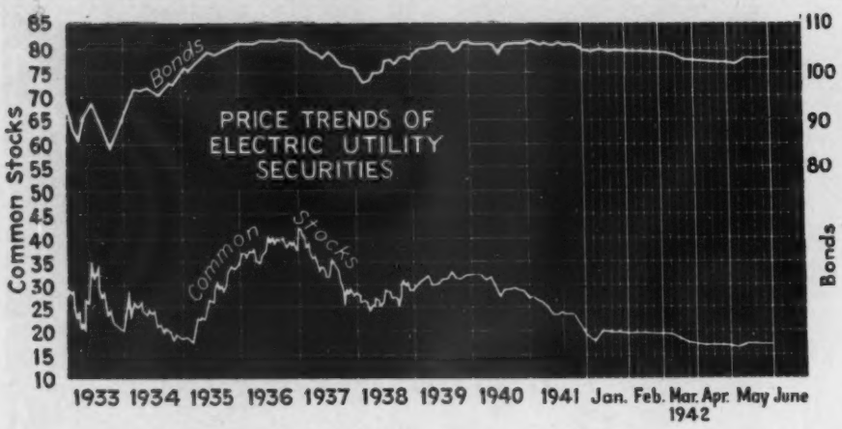
Santee-Cooper Rates Disclosed

What is believed to be the first public disclosure of rates charged by Santee-Cooper, South Carolina's $57,500,000 hydro-electric project, was made recently in a commission-approved contract whereby Carolina Power & Light will purchase 48,000,000 kw.-hr. of energy annually from the project at 5½ mills per kilowatt-hour. At this rate total cost would be $264,000.

At the same time it was learned from the Public Service Commission that a similar contract was entered into last year whereby the South Carolina Power Co. also agreed to purchase 48,000,000 kw.-hr. at the 5½-mill rate. Together, the two contracts will take approximately one-fourth of the potential total firm energy capacity of Santee-Cooper, estimated at 400,000,000 kw.-hr. annually.

Energy sold by Santee-Cooper to Carolina Power & Light will be transmitted over a 110,000-volt line owned by the power company and connected with Santee-Cooper at Pinopolis. Two other phases of the energy sale contract call for an interchange between the two of power in emergencies and for the interchange of surplus power. L. V. Sutton, president, signed for Carolina Power & Light and R. M. Cooper, general manager, for Santee-Cooper.

Slight Variations in Securities Prices


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1933 1934 1935 1936 1937 1938 1939 1940 1941 Jan. Feb. Mar. Apr. May June 1942

In line with the general market trend, there were few changes in prices of utility securities the past week. "Electrical World" stock index went to 17.5 from 17.4 the previous week; last year, 23.0. Bonds held firm at 102.3; last year, 105.7

FINANCIAL BRIEFS

EASTERN SHORE PUBLIC SERVICE CO. has filed plans with the SEC to issue and sell $1,000,000 3 percent notes for the purpose of refunding an existing note amounting to $1,000,000, due May 20, 1942, and payable to the Chase National Bank of New York. Collateral for the latter note is by $1,100,000 principal amount of its first mortgage and first lien bonds, series C, 5 percent, due September 1, 1946. The company's application proposes to issue and deliver to the Chase National its new 3 percent note, due May 20, 1944, secured by the same bonds which serve as collateral for the maturing note.

AT A SPECIAL MEETING in Wilmington, Del., stockholders of the United Corp. approved a reduction in the stated value of the company's $3 preference stock from $50 a share to $5 a share. The step, according to George Howard, president, will make it possible for the company to pay on its dividend arrearages. The company is also considering exchanging some of its utility stock holdings for its own preference stock, Mr. Howard said.

MISSOURI EDISON CO. AND EAST MISSOURI POWER have filed a registration with the SEC covering the proposed sale of $854,000 of 3¾ percent bonds, series A, due in 1967, to the Connecticut Mutual Life Insurance Co. Proceeds from the sale will be used to redeem present outstanding bond issues of the two companies.

ASSOCIATED ELECTRIC CO. has filed a declaration with SEC under the Holding Company Act regarding the acquisition from NY PA NJ Utilities Co. of the entire common stock of 115,000 shares, par value $1, and 1,572 shares of $2.80 cumulative preferred stock, no par value, of Keystone Public Service Co. for $1,832,500 principal amount of the Metropolitan Edison 6 percent secured consolidated refunding gold bonds, due 1961.

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Utility Writes Off Shanghai Investment

Following Japanese occupation of Shanghai, American & Foreign Power Co., Inc., charged off its direct investment of $2,493,000 in the Shanghai Power Co. and the earned surplus of the Shanghai subsidiaries, amounting to $3,060,000, according to a report by C. E. Calder, president, in the annual report issued last week. The amounts were written out of the consolidated surplus account.

Last remaining investment in Europe was also disposed of in 1941, the report said, for $319,785 and, except for a property in India, 99 percent of the company's investments are now concentrated in Latin America.

Utility Reports

	Net Income 1942	1941
*Arkansas Power & Light...	$2,017,768	$1,310,843
*Dayton Power & Light.....	2,217,338	3,139,892
†Detroit Edison and subs...	11,225,471	11,212,746
*Florida Power & Light....	2,023,094	2,475,641
*Louisville Gas & Electric..	1,242,128	1,162,589
*Mississippi River Power....	1,596,735	1,408,719
*New Orleans Public Service	2,268,836	2,453,051
*Oklahoma Gas & Electric..	2,375,972	2,445,857
*Pacific Gas & Electric....	21,427,916	23,819,012
*Pennsylvania Power & Light	5,720,749	8,680,869
†Public Service of N. J. and subs	17,809,882	23,618,275
*Public Service of Oklahoma	1,671,766	1,901,431
*Southern Colorado Power..	270,119	224,757
*Stone & Webster and subs	1,871,355	1,356,084
*Union Electric (Missouri)..	8,797,211	6,914,501
*West Penn Power and subs	5,259,900	4,151,946
*Wisconsin Power & Light..	1,588,619	1,570,783

* Twelve months ended March 31.
† Twelve months ended April 30.

PRIORITIES AND PRICE SHORTS

WAR HOUSING PROJECTS—no other type of housing can be built—may no longer be started without prior approval of WPB's power branch for utility service extensions. Utilities are asked to prepare such applications promptly, but not until local housing authorities indicate approval. The new arrangement is an outgrowth of the recent mess which found 100,000 dwelling units built but without adequate priorities for getting utility services (ELECTRICAL WORLD, May 23, page 6).

MECHANICAL RUBBER GOODS ITEMS are placed under a separate price ceiling formula by Maximum Price Regulation 149 issued on May 23. Maximum prices fer belting, hose and tubing, pipes and fittings, packing, tape and thread, lined tanks, and plumbers' supplies are pegged to the level of last October 1. Certain other "tailor-made" items usually sold on a bid basis may be calculated by using January 5, 1942, quotations for labor, materials and mark-up. OPA, in issuing the regulation, said it was necessary to "roll back" mechanical rubber prices to the October level in order to "achieve the purposes of the General Maximum Price Regulation."

WPB HAS ANNOUNCED an industry-wide field inquiry will be made into the inventories and uses of jewel bearings as another in its series of priorities compliance surveys. Attorney-examiners for the Federal Trade Commission have been borrowed for the job. Currently in progress are nation-wide surveys of construction started since April 9 and operations of silverware manufacturers, who ordinarily use considerable copper for alloying.

A HALF-DOZEN OR SO CORRECTIONS and minor changes are made to the vacuum cleaner price regulation (No. 111) in Amendment No. 3 issued this week. Several models previously overlooked were added to the list and a formal definition is given for attachments—"all supplementary devices which may be combined with the cleaner to increase the number of its functions and improve its efficiency."

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CEOC Constitution Ratified

Formal ratification of a constitution governing the Council of Electric Operating Companies is announced by Tom P. Walker, council president. Approval of the constitution by mail vote of the membership coincided with passage of the 150-mark in member companies.

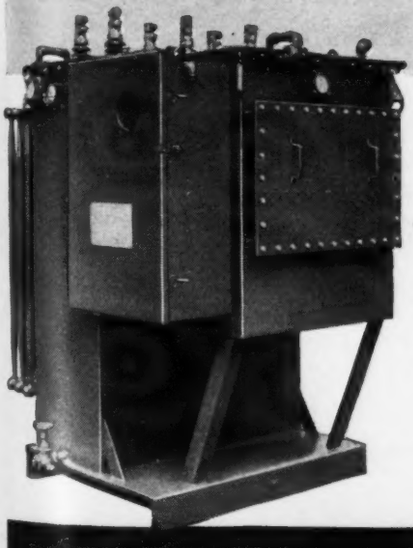
90,000 POUNDS OF COPPER*

350 MAN-HOURS*

*Savings on a typical 13.8-kv feeder by using regulators to maintain adequate voltage

You can really *save* with voltage regulators

Three-phase step regulator



TIME—the essence of all our war effort—as well as vital war materials can be saved by regulating feeder voltage. Regulators will bolster voltage that now sags under the heavy loads, permitting more electric power to flow through circuits supplying war plants.

A recent article in *Electrical World* (page 47, Jan. 10 issue) showed the surprising savings, cited above, that can be effected by using feeder-voltage regulators instead of re-building existing power lines or adding new ones.

And remember—voltage held at correct levels means good illumination for workmen, decreases waste and spoilage, and increases the response of motorized machines. Sum total—increased production!

REGULATORS OBTAINABLE QUICKLY

General Electric feeder-voltage regulators are obtainable promptly—for voltage control on circuits from 120 to 69,000 volts. Induction and step types—oil-filled, Pyranol, air-insulated—permit choice of a regulator *exactly* suited to the requirements. For complete information ask a G-E representative for Catalog GEA-2762B and Publication GEA-3779.
General Electric, Schenectady, N. Y.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

War-Time Cuts Northwest Peak 10%

Daily load composite of eight utilities is basically changed: morning load rises: afternoon peak lessened and postponed to evening — Output shrinks only slightly

LOUIS WEINER,* Bonneville Power Administration

THE President of the United States signed and approved on January 20, 1942, a Congressional Order placing the nation on a "war-time" basis, or in effect advancing the clocks of the nation one hour beginning 2 a.m. on February 9, 1942. This change was made in anticipation of a reduction of an estimated 750,000 kw. in peak load in the nation. The effect of this order on the electrical load of the major operating utilities in the western half of Washington and Oregon for a typical day in early February is quite marked.

Eight Companies Studied

Data were collected from eight major operating utilities in the region under consideration for the week immediately preceding and the week immediately following the time the order to advance clocks became effective. Inasmuch as the load of the Bonneville Power Administration is largely of the high-load-factor electrometallurgical type no effect of "war-time" was experienced and this load was excluded from the study. A careful analysis of the data received indicated that the Tuesday daily load curve was fairly typical. Composite load curves for Tuesday, February 3, under standard time and Tuesday, February 10, under "war-time" were made for the eight companies and an hour-by-hour comparison of the load was made.

The effect of "war-time" has completely changed the shape of the daily load curve. "War-time" tends to extend darkness in the early morning by one hour. It is thus to be expected that the additional lighting load would increase electrical requirements. This increase amounted to approximately 4 percent of the normal load between the hours 8 to 10 a.m. Under "war-time" the daily peak load was found to occur between 9 and 10 a.m.

Under standard time the combined daily peak load of the eight utilities considered was 785,100 kw. during a typical day in February, 1942. Under "war-time" the corresponding load was 706,400 kw., an effective decrease in peak load of 78,700 kw., or approximately 10 percent of the normal load.

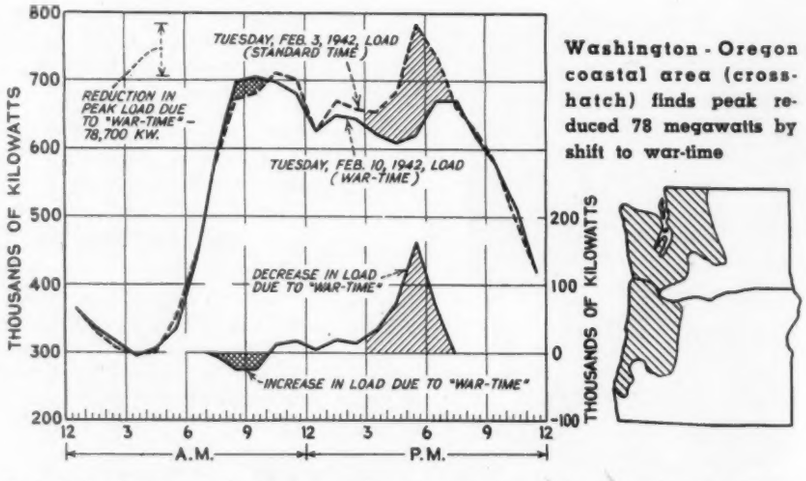
Apparent decrease in total kilowatt-hours per day as a result of the change to "war-time" amounted to 2.6 percent. However, inasmuch as normal day-to-day variation in load could very easily have been that amount, it is safe to assume that very little, if any, change in load energy resulted from the clock shift. Under these conditions it is to be expected that load factors would increase under "war-time." Normal daily load factor during February under standard time was approximately 71 percent, compared with 77 percent under "war-time."

The above conclusions generally would be minimized in the summer months and increased in the winter months at the time of the annual peak loads, whereas the geographical tendency would be to minimize the effects in regions in the southern latitudes.

Effect of "War-Time" on Utility Loads in the Pacific Northwest

Hour Ending	Combined Tuesday 60-Min. Integrated Megawatt Load of 8 Utilities		Change from Standard Time	
	Standard Time (2/3/42)	"War-time" (2/10/42)	Megawatts	Per Cent
1 a.m.	365.0	364.2		
2	333.0	335.8		
3	308.8	316.6		
4	295.6	295.6		
5	360.1	305.2		
6	352.4	335.7		
7	443.9	435.6		
8	580.0	585.4	+ 5.4	+ 0.9
9	672.2	698.5	+ 26.3	+ 3.9
10	682.0	706.4*	+ 24.4	+ 3.6
11	711.7	699.1		
12 Noon	701.0	682.0		
1 p.m.	627.6	627.0		
2	673.3	652.1	− 21.2	− 3.2
3	659.8	643.6	− 16.2	− 2.5
4	657.4	622.3	− 35.1	− 5.3
5	687.0	608.9	− 78.1	− 11.4
6	785.1*	621.0	−164.1	− 20.9
7	738.5	671.3	− 67.2	− 9.1
8	663.9	672.4		
9	625.7	621.7		
10	581.3	577.7		
11	492.8	510.0		
12 Mid.	422.4	419.2		
Total MWH/day	13,360.5	13,007.2	−353.3	− 2.6

*Daily peak load.



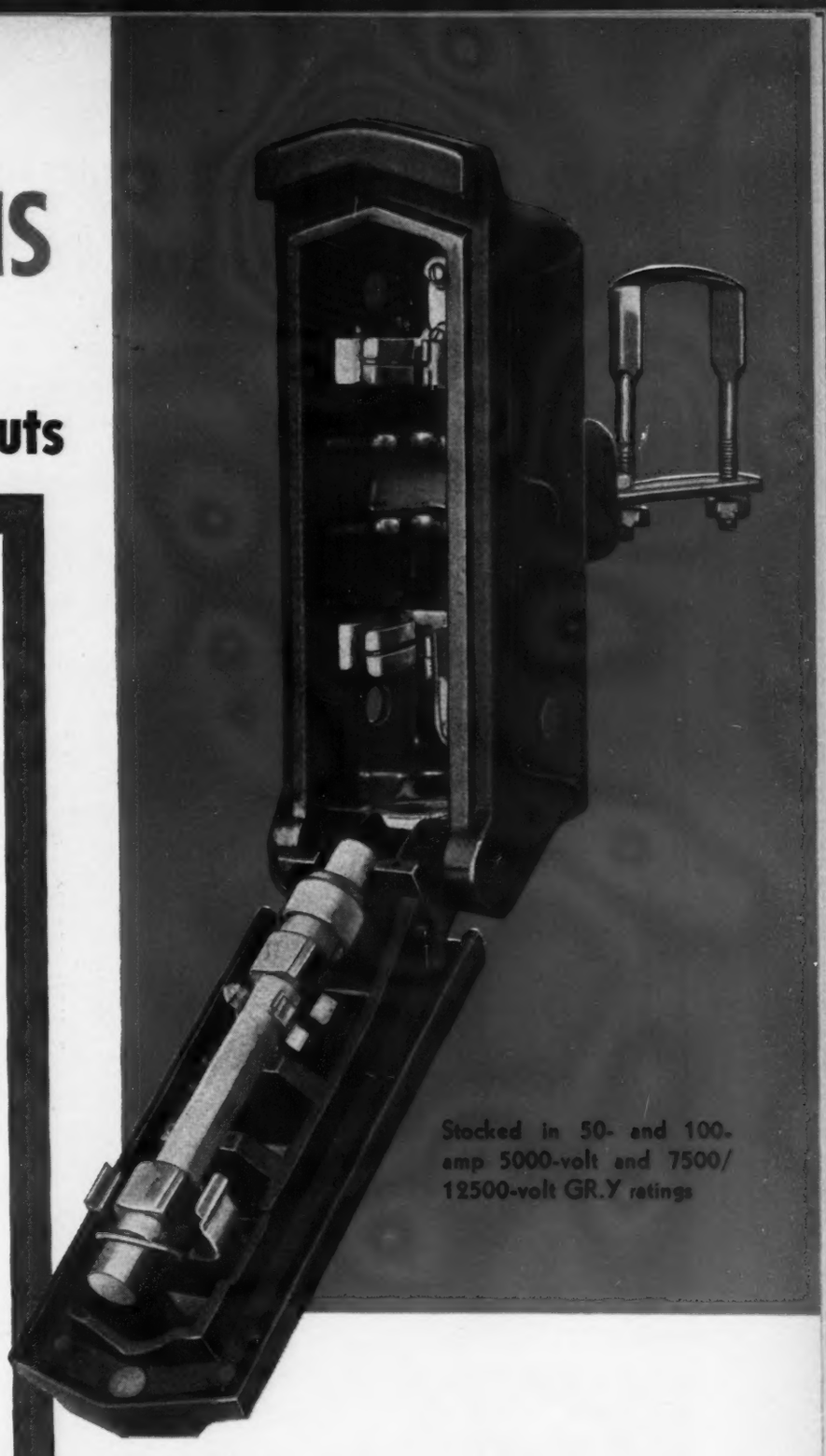
Washington - Oregon coastal area (cross-hatch) finds peak reduced 78 megawatts by shift to war-time

Typical Tuesday has peak at 5-6 p.m. Top 10 percent served only two hours in February; even less in December (month of annual peak). War-time increased early morning load (8-10 a.m.), but no critical load occurs in the afternoon—the peak was decreased and deferred from one to two hours. Little difference before 8 a.m., from 10-3, and after 8 p.m. Peak reduced 21 percent at 5 p.m.

*Assistant engineer power planning section.

6 REASONS for Preferring G-E Nonindicating Cutouts

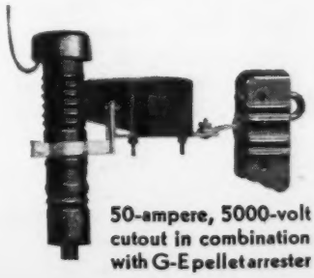
1. They are the lowest in price of all wet-process, porcelain-enclosed cutouts. You can make appreciable savings by using them where indication is *not* necessary.
2. Parts are standardized. All contacts, fuseholders, and other parts have been interchangeable since these cutouts were introduced, in 1928. This reduces stock requirements and maintenance costs.
3. The fuseholder, the barriers on the doors and in the cutout, and the housing are all of sturdy construction. Exhaustive tests and 14 years of service operation prove that these parts successfully fulfill the requirements of interrupting duty.
4. Heavy-duty, silver-plated contacts of the high-pressure-blade type provide long life and low-operating temperature even under heavy loading and unfavorable atmospheric conditions.
5. These cutouts function without movable parts, and regardless of atmospheric conditions.
6. The hanger clamps to the crossarm and provides a choice of vertical or angle, straight or swivel mountings. It is also interchangeable with the hanger of G-E indicating cutouts.



Stocked in 50- and 100-amp 5000-volt and 7500/12500-volt GR.Y ratings

High standards of reliability, simplicity, and safety have been established by the G-E wet-process-porcelain, nonindicating enclosed fuse cutout. Since 1928 a million and a quarter have been put into service, and their operating record is excellent.

50-ampere, 5000-volt cutout



50-ampere, 5000-volt cutout in combination with G-E pellet arrester

Savings Possible

You can make appreciable savings by installing nonindicating cutouts. They can be used for all transformer installations except those having secondary banking, where indicating cutouts are desirable. Where nonindicating cutouts are used, the location of an outage is revealed by the telephone calls of power consumers.

For complete information on G-E cutouts of this type, call your G-E office or write for Bulletin GEA-2390. *General Electric, Schenectady, N. Y.*

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

406-10-5254

GENERAL ELECTRIC

Bicycles, Motorcycles Answer Tire-Gas Rations

Utilities adopt two-wheeled vehicles to curtail use of rubber — Fuel and automotive equipment for short runs of meter readers, servicemen, patrolmen

TRUE though it is that utilities are permitted to buy new truck tires under existing rationing schedules, a few electric utilities in various areas have already moved to use smaller vehicles for short trips of lightly burdened employees. They are thus making one further contribution toward alleviating the shortages occasioned by war absorption of critical materials and productive facilities. Many others are reporting extensive curtailment of travel by automobile; one cited herewith circulates an office on wheels so as to reduce travel to small offices.

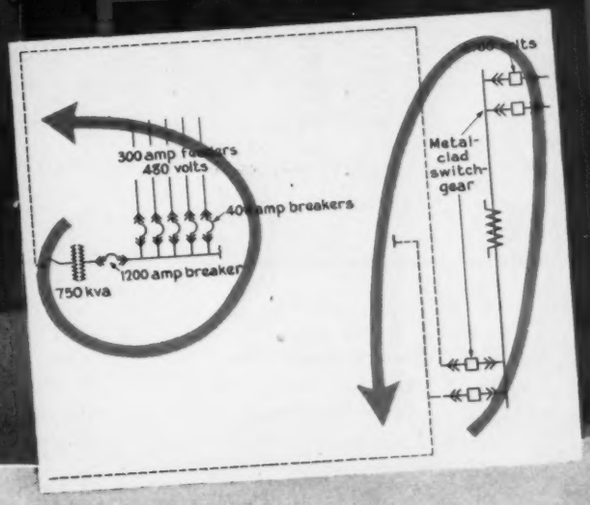
TEN MOTORCYCLES purchased by California Electric Power Company at Riverside. Five are of the conventional side-car type and five are the three-wheeled type with rear-mounted box body. They are used by service men, patrolmen and others in place of conventional cars. In addition the company bought ten bicycles for meter readers, messengers and other employees whose work is confined to the limits of the communities served

ASIDE from strict emergencies, the only company transportation between Riverside, headquarters of the California Electric Power Company, and its Imperial Valley territory, 165 miles away, is this new "bus" purchased to conserve tire mileage. The new car carries inter-office correspondence, express and light freight as well as passengers. It makes the trip in one direction one day and back the next, stopping at various district offices enroute

CHIEF METER READER of the Patchogue (N.Y.) Electric Light Company makes his appointed rounds on a bicycle.

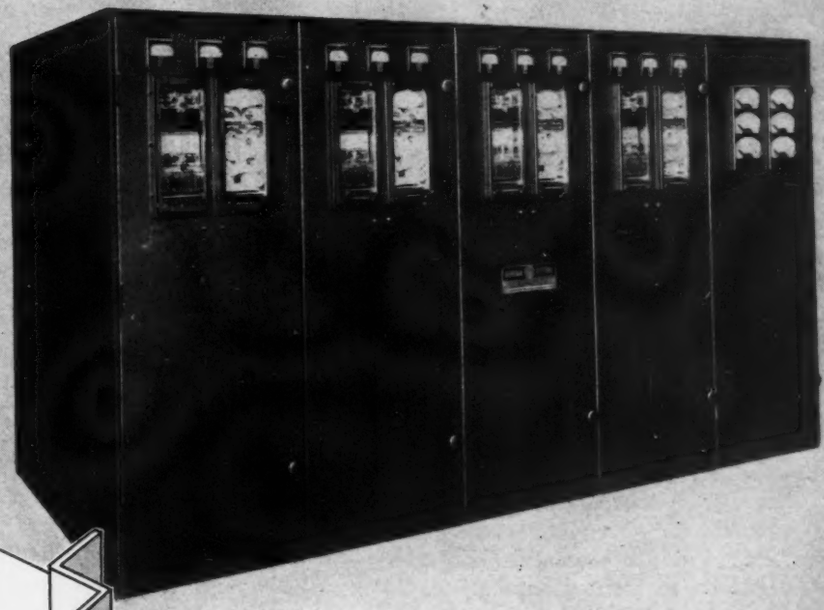
PHILADELPHIA ELECTRIC fits out Bob Hawkins, service maintenance troubleman, with a new bicycle. Fifteen others have been provided for other troublemen and meter readers. Distant calls will continue to be handled by light service cars and trucks

A SIMPLE ONE-LINE DIAGRAM PUTS US TO WORK ON STANDARD EQUIPMENTS

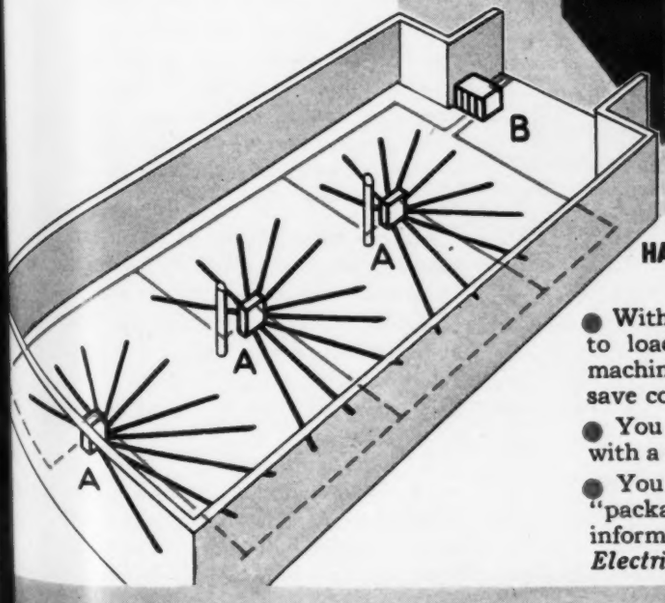


A *Load-center Unit Substations*—including transformer and high- and low-voltage protective and disconnecting devices, all co-ordinated as a single, safe, compact, easy-to-install unit.

B *Metal-clad Switchgear Equipments*—for protecting primary circuits up to 15 kv. A safe, co-ordinated assembly of breakers, instrument transformers, buses, and associated equipment.



General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.



HAVE LOAD-CENTER POWER BEFORE THE FIRST MACHINE IS READY TO ROLL

- With load-center distribution, power at high voltage goes right to load-center unit substations, and then directly to your machines through *short* low-voltage secondary feeders. You save copper, steel and dollars.
- You can order *standard* G-E load-center equipments *early*—with a one-line diagram. Get everything you need—weeks sooner.
- You get them ready to set in place and connect—in compact "packages" that can be put in otherwise "dead" area. For full information, contact your nearest G-E Office, or write *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

854-17-7800

Station Modifications Save Critical Materials

Wood and other materials substituted for metals where safe — Construction-period features are retained for operation for the duration — Accessories minimized

ON THE Atlantic seaboard the Philadelphia Electric Company, which is erecting the large Southwark station, has adopted a rigid policy of modifying, deferring or reducing the original plans so that critical materials can be conserved by substitution or elimination.

These measures cover a wide range of features of the design and construction:

Yard Fencing — Substitution of wood in place of steel.

Doors for Buildings—Wood in place of metal.

Hardware—Reuse of any hardware used during plant construction, or use of substitute materials in place of metals.

Building Steel — Elimination of framing and column cover plates in the area to be occupied by the boilers and auxiliary equipment for the future second unit; elimination of superstructure support for the future second unit turbo-generators and the framing for related auxiliary equipment.

Floor Grating and Plates—Continued use of temporary construction walkways and platforms in locations where fire hazards are not serious.

Hand Rails—Continued use of wood construction hand rails.

Stair Treads—Continued use of wood construction treads, except in locations where fire hazards are serious.

Lighting and Fixtures—Continued use of construction installation.

Plumbing—Minimizing the quantity of plumbing fixtures and piping.

Piping for Roof and Floor Drainage—Substitution of transite, terra cotta or other material in place of cast iron or steel.

Windows—Substitution of glass block in place of metal sash.

Ventilation—Substitution of asbestos sheeting in place of steel plate for duct construction.

Evaporator and Related Heat Exchanger and Appurtenances—Elimination of one such system together with related tubes and piping.

Trench Covers — Substitution of wood, concrete or other material in place of metal.

Inclosures for Main Generator and Transformer Leads—Substitution of concrete in place of metal.

Machine Tools—Utilizing the construction shop equipment in the new maintenance shop.

Control Panels—Substitution of bakelite or slate in place of steel.

Telephone Booths, Cabinets, Bins, Lockers, and Furniture—Substitution of wood in place of metal.

Chlorine Tank Racks—Substitution of wood in place of steel.

Head and Treating Tanks for River Water, Receiving and Head Tanks for City Water, Coagulating Tank, Clearwell, Anthracite Filters, Condensate Storage Tanks—Substitution of wood in place of steel plate.

Lubricating and Transil Oil Tanks —Elimination of one tank each, together with related piping.

Piping—Minimizing the quantity where possible.

Roof Flashing—Substitution of fibrous materials in place of copper.

Roof—Substitution of wood roof in place of reinforced concrete on the turbine house and the boiler house in locations where fire hazard is not serious.

Coal Hoisting—Substitution of an outdoor, boom crane in place of a coal tower with hammer head type crane, for unloading coal from barges to station.

Circulating Water Intake Ducts—Substitution of reinforced concrete duct in place of steel duct for pressure flow.

Chemical Pumps—Substitution of chrome-plated pistons in place of stainless steel pistons.

Superheaters—Substitution of carbon steel tubes in place of alloy tubes.

Soot Blowers—Substitution of wall type soot blowers having retractable carbon steel elements in place of a type of soot blower having fixed alloy steel elements.

Ash Pit—Substitution of reinforced concrete in place of sheet metal piling in walls of ash pit.

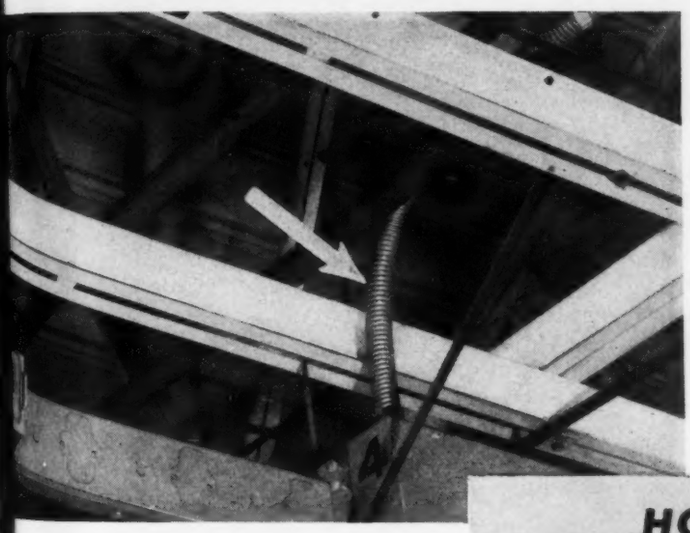
Insulation—Elimination of rosin-sized paper, asbestos paper and waterproof paper as sub-finish for jackets on piping insulation; elimination of wire mesh support for asbestos cement from equipment insulation; substitution of pasting in place of sewing of canvas jackets where possible; substitution of canvas packets in place of asbestos jackets on valves and adjacent to pipe hangers.

Valves—Substitution of standard valves in place of valves with special by-passes; elimination of a number of small valves by combining the by-pass and drain line on large valves; substitution of screwed valve seats in place of seal-welded valve seats.

In addition there are in prospect tentative modifications involving the elimination of dust collectors, dust tanks, flyash mixers and piping. Steel plate may be eliminated in the lower part of the boiler casing.

Saves Vital Materials and Goes Up Fast

*No. 1799 Varnished-cambric Interlocked-armor Power Cable



FOR REDISTRIBUTION. Here v-c interlocked-armor (600-volt) cable feeds into Trumbull Flex-A-Power bus for redistribution to the machines. This is a 500,000-cir mil cable.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

SPEAKING OF SAVINGS!

This cable is ideal for use with G-E unit substations for Load-center Distribution—a practical means of bringing the economies of high-voltage power indoors, close to the point of use, where it is redistributed at lower voltage. Ask for publication GEA-3758.

IF ever there was a cable of the hour this is it! You can install it in less time than previous combinations. It saves tons of vital materials; and electrically it's as good as, or better than, the combinations previously used for power runs up to 15,000 volts.

Are you planning new or additional construction for war production? If so, we'd like to help you make advantageous use of v-c interlocked-armor cable in your plant layout, and figure what the estimated savings will be. Consult our office in your locality, or write to General Electric, Schenectady, N. Y.

HOW MUCH DOES IT SAVE?

Calculations based upon requirements for a 3000-kva load—floor space, 450 by 700 ft

DISTRIBUTION METHOD	POUNDS OF MATERIALS			
	COPPER	STEEL	OTHER	TOTALS
Conventional Radial—with Rubber Cable* and Conduit	18,500	43,500	4600 (mostly rubber insulation)	66,600
Conventional Radial—with V-C INTERLOCKED-ARMOR CABLE	13,600	5,070	4420 (rubber negligible)	23,090
SAVINGS	4,900	38,430	180	43,510
Load Center—with Rubber Cable* and Conduit	4,560	16,150	4190 (947 lb rubber)	24,900
Load Center—with V-C INTERLOCKED-ARMOR CABLE	3,420	2,015	4140 (rubber negligible)	9,575
SAVINGS	1,140	14,135	50	15,325

*Based on 30%, 60 C rubber insulation.

GENERAL ELECTRIC

501-12-1200

Los Angeles Street Lights Equipped for Quick Blackout

System of four basic manual controls worked out for 627 remote points operating 65,000 lights — Volunteer organization of 3,700 recruited and trained for speedy manipulation in case of alarm

O. W. HOLDEN,* Los Angeles Bureau of Power and Light

FOR YEARS Los Angeles has proudly considered its elaborate street lighting as a valuable asset, but on December 7, 1941, it suddenly became a definite liability as the necessity for quickly blacking out some 90,000 lights became imperative. Of these 90,000 lights, 17,000 were utilitarian type on series circuits mostly controlled from attended distribution stations. The remaining 73,000 lights were electrolier type, of which only about 18 percent were station controlled, some by means of special primary feeders and some by carrier current, leaving about 65,000 lights automatically switched by more than 800 time switches in the field, a method which for years had been both economical and satisfactory.

By discontinuing lighting in the parks, limiting the lighting in pedestrian tunnels to one luminaire in the middle where it is sufficiently obscure, and not counting midnight switches which are master controlled by all-night switches, the actual number of control points in the field to be hand-operated in case of a blackout was found to be 627.

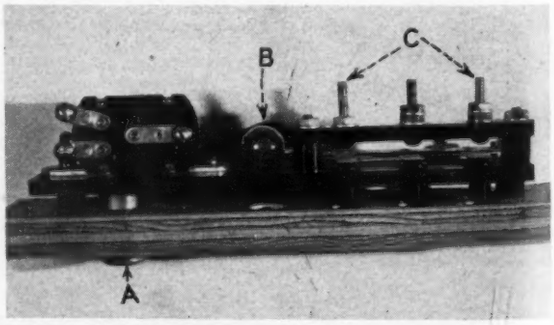
The first plans for emergency blackout called for utilizing the bureau's own street-lighting maintenance crews to hand operate the time switches. Although the plan was well organized before hand, it failed in its first trial largely due to the fact that the military order for blackout was announced over the radio and not indicated by siren, as had been previously agreed. In the resulting confusion the crews were delayed in starting on their assigned routes and were further hampered by the necessity of driving slowly through streets already dark where police and self-appointed citizens repeatedly stopped them for questioning. Many of the lights were not extinguished until long after the alarm.

Travel Averted

Consequently, it was quite apparent that any scheme of blacking out involving travel must be abandoned. The interest of the public in the blackout failure prompted the idea that citizens living near the switches might be enlisted in a volunteer organization to trip them off in emergency. Accordingly, while engineers devised various means for quick manual operation of the switches, an organization was completed, enlisted first from the bureau's own personnel and then from the citizenry, built up of "district chiefs," "switch captains" and "alternates," so that each switch was provided with two to five persons responsible for its operation.

Adaption of the switches to simple manual operation was somewhat of a problem as there are many kinds, makes, schedules and methods of application involved. The problem was further complicated because switch operations normally occur at dusk, midnight and dawn, and switch positions which govern the lighting of the street light circuits on the various schedules change with each operation, so that any of several conditions can prevail at the time when the blackout signal or all clear signal may occur.

VOLUNTEER "switch captain" operating one of 627 manual controls that blackout Los Angeles street lights in case of an air raid alarm



Automobile light dimmer switch (A) transfers control from time switch to manual, lighting of lamp (B) indicating the transfer. The three contacts (C) correspond with dusk, midnight and dawn operations of time switch. Equipment is mounted inside time switch box and is operated by a stick poked through holes in the box.

BLACKOUT switching device for emergency control of latch-in type of solenoid switch

* Electrical engineer.

AN ELECTRICAL WHOLESALER HELPS SPEED WAR PRODUCTION

WESCO met 3-day deadline for 18 products

Steel Plant Started Production 60 Days Quicker; Saved 74 Paper Transactions.

A large Southwestern steel plant under construction suddenly needed $14,000 worth of priority products. Altogether, 18 items from 6 manufacturers were required. A hurry call to the local WESCO House got fast action. WESCO delivered the complete order in 3 days. Deliveries by the manufacturers involved, would have taken a minimum of 60 days longer—*in some cases 9 months.*

Important, from an internal cost point of view, WESCO saved the customer the burdensome detail of handling 6 orders, 6 acknowledgments, 20 follow-ups, 12 shipments, 12 bills of lading, 12 invoices and 6 checks to issue.

Today's war plant building calls for hair-trigger speed in assembling and delivering material to meet crucial deadlines. WESCO speeds war production because each of its 79 Houses stocks great variety and quantities of apparatus and supplies and knows how to get things done for customers. Today that efficient service steps up war production. Tomorrow it will speed the reconstruction of business.

WESCO SPEEDS WAR PRODUCTION

* A $50,000 machine that would release 20 men for war production work stood idle for want of wire. Best delivery from manufacturers was 5 to 8 weeks. WESCO delivered the wire the following day.
* WESCO saved a 37-days' delay in a Naval Ammunition Depot by providing from stock, with engineers' approval, a type of transformer equally as efficient as a non-available type specified.

WESCO SERVES BUSINESS

* By maintaining perpetual inventory stock records.
* By extending credit to help finance jobs.
* By assembling all parts of an order in one shipment.

Westinghouse

ELECTRIC SUPPLY COMPANY

150 VARICK STREET · NEW YORK, N. Y.

The name that means everything in electricity

A NATIONAL DISTRIBUTING ORGANIZATION WITH 79 BRANCHES

March 1942

CODE AVA
SCHEDULE All Night

BLACKOUT INSTRUCTIONS

TIME SWITCH STATION NO. TS 914

LOCATION 11564 SUNSET BLVD. (AT LATTON DR)

MAKE AND TYPE OF SWITCH 10 Amp. 110 Volt States with RC A

This street light time switch can be manually operated in blackout emergency by opening the pedestal box with a key furnished for the purpose and manipulating the small toggle switch and push buttons on the right hand side. The transformers and main high voltage switch are underground in a vault.

TO BLACKOUT LIGHTS:

1. Trip the small toggle switch to the lower or "M" position, which transfers control to the manually operated buttons and also prevents the time switch from automatically turning on the lights during the blackout.

2. Push the lower button and the street lights will immediately go out. Toggle switch remains in lower position.

TO RESTORE SERVICE TO NORMAL AFTER "ALL CLEAR" SIGNAL:

1. Be sure small toggle switch is in lower or "M" position.

2. Push upper button and the lights will come on.

3. Trip toggle switch to upper or "A" position which will restore normal control to the time switch.

4. If the "all clear" signal is given in the morning after daylight first appears, omit Paragraph 2 and proceed to Paragraph 3, as the time switch has probably already performed its OFF operation.

THIS TIME SWITCH CONTROLS LIGHTS AT THE FOLLOWING LOCATIONS:

Sunset Blvd. between Gunston Dr. & Barrington Ave.

IF YOU HAVE ANY TROUBLE CALL ~~Michigan 4011~~ ~~San Pedro 1454~~ Arizona 9-3771 ~~State 5-2111~~ "Street Light Blackout"

ONE of the 24 basic coded instruction sheets prepared for volunteer "switch captains" and alternates who blackout street lights

It was early recognized that any control method adopted must meet the following requirements:

1. Be quickly manipulated by an unskilled operator.
2. Permit the operator to restore service to normal immediately after the blackout period.
3. Not interfere with the normal timing and mechanical operation of the switch.
4. Prevent the switch from automatically switching on lights during the blackout period.
5. Discourage tinkering with the switch mechanism.

Four Schemes Devised

Four general methods were finally devised to fit the various time switch installations throughout the city. The first applies to low-voltage multiple lighting or to lights controlled by means of a contactor, and consists of a small toggle switch or a simple double-pole knife switch cut in the circuit between the time switch and the load. The switch is mounted on the bottom of the box which houses the time switch and is reached by means of a stick furnished to the switch operator. This method disconnects the load without interfering with the electric timing of the time switch. The standard stick is a piece of $\frac{1}{2}$-in. doweling 3 ft. long with a screw crosswise near one end, and the same stick can be used to operate any of the several types of controls.

The second method is used with high-voltage, mechanically operated switches, in which the timing and tripping mechanisms are inclosed in a cast-iron case with a hinged door. This problem was solved by removing the lock, reaming out the lock hole and fitting a shaft in the hole with an arm on each end of the shaft. The inside arm contacts the manual tripping lever and a chain attached to the outside lever extends down through the bottom of the wooden housing, terminating in a ring. The principle of normal operation of these switches is that an alternate ON and OFF operation occurs with each tripping operation, whether automatic or manual. However, an automatic operation at midnight or dawn following an emergency OFF operation would reverse the switch position and restore the lights. To prevent this occurring a hook is provided under the bottom of the switch box and after the chain is pulled the ring is slipped over the hook, thus locking the mechanism.

High-Mounted Switches

A third scheme applies to electrically operated high-voltage switches which are generally mounted high up on the pole. This type of switch is equipped with a motor which winds a spring until sufficient energy is stored and then trips the operating mechanism. Motor wiring of these switches is similar to the ordinary three-way switch scheme in house wiring, one double-throw switch being tripped in alternate positions by the clock to start the motor and the other tripped at the end of the winding operation to stop the motor. The blackout switch is a double-pole, double-throw baby knife switch mounted on the pole in a simple housing, 8 ft. above the ground, and is connected in the motor control circuit between the two double-throw switches mentioned above. To blackout, the switch is thrown to the opposite or lower position and left from one to three minutes until the motor winds the spring and trips out the main contacts. The blackout switch is then opened, which prevents any automatic operation during the blackout period. To restore service the blackout switch is simply closed in the upper or normal position.

The fourth method applies to the bureau's special latch-in solenoid switch, one form of which is installed in an underground vault and remotely controlled by a time switch in a pedestal box at the curb. The solenoid switch contains two 4,800-volt contacts, one for all-night circuits and one for midnight. The three solenoids are energized by momentary contacts in the time switch, one at dusk, one at midnight and one at dawn.

It was a simple matter to provide three push-button contacts to duplicate the time switch contacts, together with a small double-throw toggle switch to transfer the control circuit from time switch to push buttons. This equipment is mounted in the pedestal box and the operator furnished with a key.

Single-Schedule Control

For the cases where the solenoid switch handles a single schedule, either all night or midnight, only two push buttons and a toggle switch are required.

This same type of solenoid switch is also found installed on poles, with the time switch housed in a wooden box 8 ft. from the ground. Holes are drilled in the bottom of the box through which the operator pushes up with a stick to make the various contacts. Instead of the toggle switch used in the pedestal box, an automobile headlight dimmer switch is employed. This switch transfers con-

Bus Conductors of Copper power essential industries . . . HERE'S WHY!

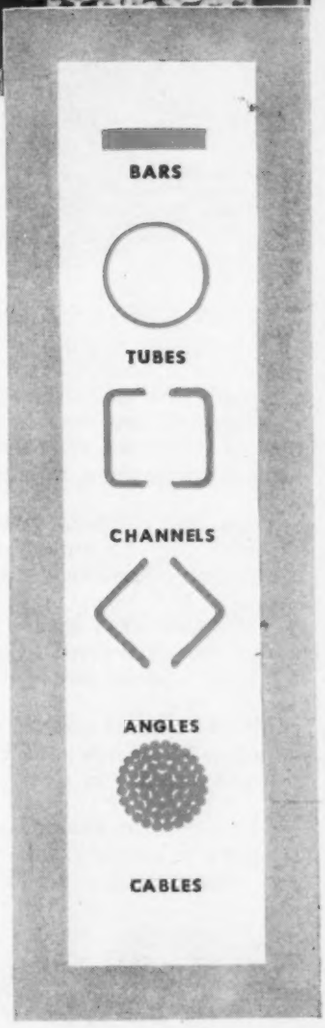
BECAUSE of its unsurpassed high-conductivity and consequent low current losses, copper has proven to be the most dependable and efficient bus material.

To these advantages may be added such further qualifications as high thermal conductivity, high strength, high resistance to corrosion and ready availability of accessory equipment. It is for these reasons that copper lends itself to more efficient bus constructions.

Wherever modern electrical engineering practice dictates bus construction embodying structural strength, low ohmic and reactance losses or effective heat dissipation, the range of copper bus shapes made by The American Brass Company will meet every requirement, for, in addition to a complete line of copper bus bars of rectangular shapes, this Company makes high-conductivity pipe and tube, stranded cables and special shapes.

Of particular interest to electrical engineers are the ventilated busses made from channels, angles, tubes and rectangular copper bars. Information, including the suggestions of our Technical Department on various bus conductors and assemblies, is available on request.

A new edition of our Bus Conductor Booklet, C-25, is just off the press. We will gladly send you a copy on request. 4390



ANACONDA
from mine to consumer

Anaconda Copper

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut
Subsidiary of Anaconda Copper Mining Co. • In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

TAMING MANHOLE FIRES

WHEN a blaze breaks out in a manhole, you may have trouble on your hands. For one thing, temperatures may run high; for another, the fire may hide out in the ducts—far out of reach of ordinary extinguishing agents.

Hit these fires with Kidde carbon dioxide gas. First, because Kidde gas is one of the fastest known fire-killers. Second, because it is safe on electrical fires, harmless to equipment. Here are some specific suggestions:

Have ample extinguisher-capacity, since you may have to flood entire hole. Fire may be out of sight. As a rule, don't try to use anything smaller than the Kidde 15-pounder.

Get a Kidde Trailer Unit for manhole fire-fighting. They give you the power of several hundred pounds of carbon dioxide capacity. Their special heavy-duty nozzles make extinguishing easier.

If fire's spread to cable ducts, dump Kidde gas into manholes at both sides of trouble spot. Converging clouds of fast-expanding Kidde gas trap fire in a jiffy!

Recent Fire Report says, *"Manhole resembled furnace! Completely extinguished with Kidde Wheeled Unit in less than 60 seconds!"* Can you kill 'em this fast? Write today for all details.

Kidde (K Kidde)

Walter Kidde & Company
Incorporated
547 West Street, Bloomfield, N. J.

trol from time switch to manual, and *vice versa*, each time it is pushed. To indicate which way the dimmer switch has last been thrown, a small indicating lamp is provided which lights whenever the switch is on manual control.

The above descriptions cover the fundamentals of the four general methods, but to adapt them to some of the existing installations a number of minor variations were necessary either in the installation or in the method of operation.

Long Artery

City authorities were much concerned about Wilshire Boulevard because it consists of 7 miles of uniformly well-lighted thoroughfare into the heart of the city. To provide a central control for instantly blacking out the street lights, a telephone drop wire was strung along the posts connecting the twelve control points to a convenient distribution station. The scheme involves telephone relays and intermediate relays controlled over a telephone pair and ground, making it possible to blackout street lights and lock out the normal time switch control during the period and later to store service to normal.

Handling the personnel, mostly non-technical, was a task. A "blackout" office was set up, the first duty of which was to find individuals living near each control point who would be willing to serve, and to appoint them as "district chiefs," "switch captains" and "alternates." These individuals were then instructed how to operate the switches, either at their assigned switch or at a demonstration installation.

The office then developed and put in operation a scheme of notification by which over 40 outgoing telephone lines the office staff can call the district chiefs, who in turn telephone their captains or alternates. Within a few minutes of an "alert" signal at least one operator for each control point is notified to "stand by," and when the sirens throughout the city sound the "blackout" signal the switch operators hasten to their assigned switches and trip them off. The entire blackout organization involves about 3,700 individuals.

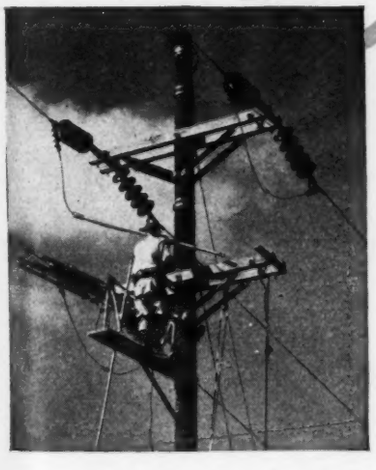
To cover all of the 627 control points it was necessary to write 24 instructions, each identified by a code. Every switch captain and every

DEFENSE INDUSTRIES DEMAND—

CONTINUOUS *Energy*

with KEARNEY

Hi-LINE TOOLS



For years, demonstrations and instructions in the handling of live line tools on "hot jobs" have been conducted by experienced Kearney Live Line Tool Specialists. These demonstrations are available to any power company.

AGAIN credit the skill and workmanship of American line crews with doing what it takes to keep current flowing, to keep wheels turning in National Defense industries.

Armed with live line tools and accessories, trained linemen, yours, too, no doubt, can avoid costly delays in electric service and plant shut downs by doing jobs "hot" . . . they can increase pole heights, tap new line extensions, replace insulators and a host of other jobs without a moment's retarding of production . . . for Defense Production.

JAMES R. KEARNEY CORPORATION
4224-42 CLAYTON AVE. ST. LOUIS, MO.
Canadian Plant • Toronto, Canada

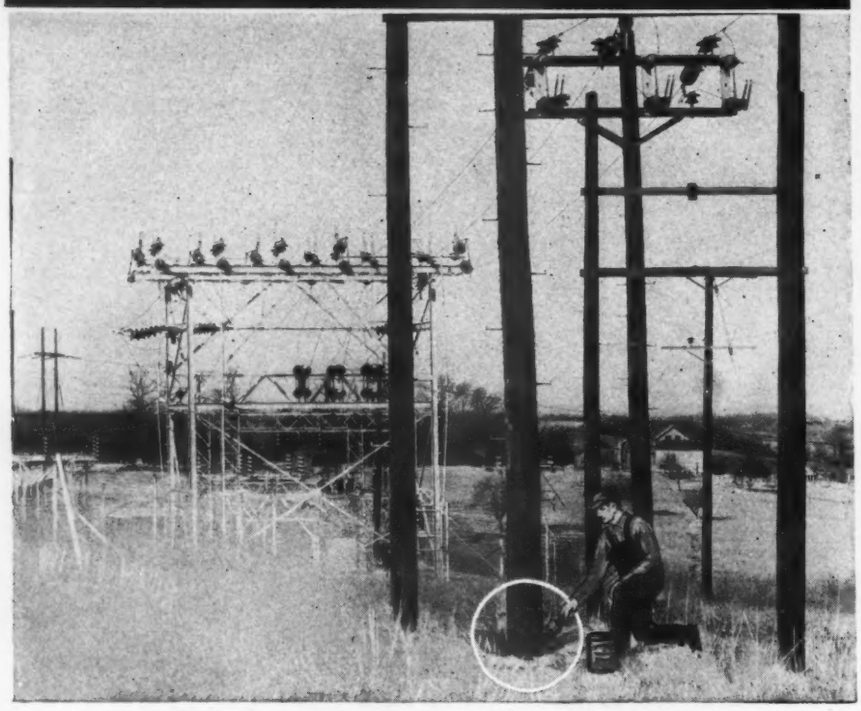
KEEP THEM WORKING *with*

KEARNEY PRODUCTS

VITAL TO DEFENSE

UNINTERRUPTED

POWER SERVICE



Osmoplastic Groundline Treatment

keeps poles standing longer thereby reducing replacements and possible power failures

All out war production work calls for uninterrupted power service. You can guard against possible power shut-offs due to pole failures at the groundline by using the Osmoplastic groundline treatment. This easy to use yet highly effective treatment, applied at the groundline, increases the service life of untreated or "B" treated standing poles many additional years thus reducing costly replacements. And because Osmoplastic retards groundline decay, frequent pole inspections are eliminated. Actual service records of over 60 leading utilities prove that the Osmoplastic groundline treatment saves money by increasing standing pole life 7 years or more. Make Inspection time Osmoplastic protection time.

OSMOSE
WOOD PRESERVING COMPANY
BUFFALO, NEW YORK

Write for FREE Bulletin
The new fully illustrated descriptive Bulletin 242-E showing the uses and advantages of Osmoplastic groundline treatment will be sent on request.

alternate is furnished with an instruction sheet with instructions applying only to his particular control point, together with a key or standard stick needed to reach the blackout equipment. The instruction sheet gives the locations of the lights controlled by the switch and shows whether all-night or midnight schedule (midnight is now 1 a.m. War Time).

The coded instructions are also furnished in bound sets together with a cross index showing time switch number and the code symbol of instructions which apply. The bound sets are issued to district chiefs, police and others who are authorized to operate switches in case the appointed operators should fail.

A number of actual blackouts have demonstrated that although some equipment and some personnel failures have occurred, the great majority of lights are extinguished within four minutes after the sirens sound the blackout alarm. However, the Bureau of Power and Light officials feel that as an emergency measure, pending the establishment of a permanent centralized control, the scheme is quite satisfactory.

•

Ideal Conditions for Demand Register Work

Near ideal conditions for the checking and repair of demand meter registers mark a corner of the Oklahoma Gas & Electric Company's meter shop. Convenient cupboards for work in process and drawers under bench for necessary tools and accessories are provided. Work plane is lighted at 90 ft.-candles by four 36-in. daylight fluorescent lamps 36 in. above the bench and behind diffusing glass.

USE THESE *two new* TIMELY MOVIES

Help your Customers use their Electric Appliances

★

Support the National Drive for Better Nutrition

"40 BILLION ENEMIES"

This interesting and educational sound motion picture urges every customer on your lines to do a better job of keeping house electrically. The film features the electric refrigerator and the importance of proper food preservation in maintaining the Nation's health.

Housewives are shown how to use an electric refrigerator to best advantage—how to place foods in an electric refrigerator for maximum protection against deterioration and loss of vital health values. Emphasis is placed upon the care of electric refrigerators in the homes of customers on your lines.

This is a 16 mm. sound motion picture in full color and the running time is 26 minutes.

"V-MEN"

A fast-moving, authentic story stressing the importance of proper cooking methods to preserve vitamin content of foods. It tells about scientific research that is contributing so much to the health of the Nation—research proving that the homemaker plays an important part in her kitchen in winning the war. This non-commercial sound motion picture is in black and white, 16 mm. or 35 mm. Running time — 17 minutes.

Part II, "V-Women," gives convincing proof that the scientific method for preserving vitamins is easy with a Westinghouse Range. This section, for use only when a commercial story may be added to "V-Men," is in full color with sound, 16 mm. only. Running time—6 minutes.

With these films you can conduct a very effective and inexpensive Customer Relations Program. Your Westinghouse distributor will gladly preview them for you and give you details of a new plan which is available now to utilities.

Westinghouse

Copyright 1942 by
Westinghouse Elec. & Mfg. Co., Mansfield, Ohio

REFRIGERATORS AND ELECTRIC RANGES

LOAD BUILDING

Commercial Revenue From Bowling Alleys

By F. H. MEIER
Lighting Engineer Consumers Power Co., Muskegon, Mich.

If it is true that bowling can be improved by perfect surroundings, then the scores at the new Michigan Bowling Center in Muskegon, Mich., will be way above the average. E. E. Valentine, the architect, in cooperation with the Brunswick-Balke-Collender Company engineers, recently planned and supervised the installation of the most modern and completely equipped set of sixteen alleys in the world.

Among the predominant features is the use of fluorescent lamps throughout the entire area, from localized lighting of the bowling pins to general illumination. Fifty foot-candles of light are provided over the pins by two 15-watt white fluorescent lamps. The alleys are lighted by four rows of almost continuous 40-watt white Mazda F. lamps mounted 11 ft. above the floor and installed in porcelain reflectors. As may be seen in the accompanying illustration, the ceiling is designed in a sawtooth arrangement, thus shielding the lamps and fixtures completely from view. There are 17 ft.-candles of light on the alley surface and fixture reflection is entirely eliminated.

Just back of the foul line over the approaches are suspended three-bulb fixtures. Two of the bulbs are covered with frosted glass to supply general down light, and one bulb is located in the top of the unit to provide ceiling light to eliminate contrast in the room.

UTILIZING much service at off-peak hours, this bowling alley on Consumers Power lines yields commercial revenue from fluorescent lighting, filament lighting, electric scoring machines, projectors, photoelectric cells, electric heating and air conditioning

Illumination over the scoring and spectator areas is 25 ft.-candles supplied by glass-covered ceiling-mounted fixtures with 40-watt white fluorescent lamps.

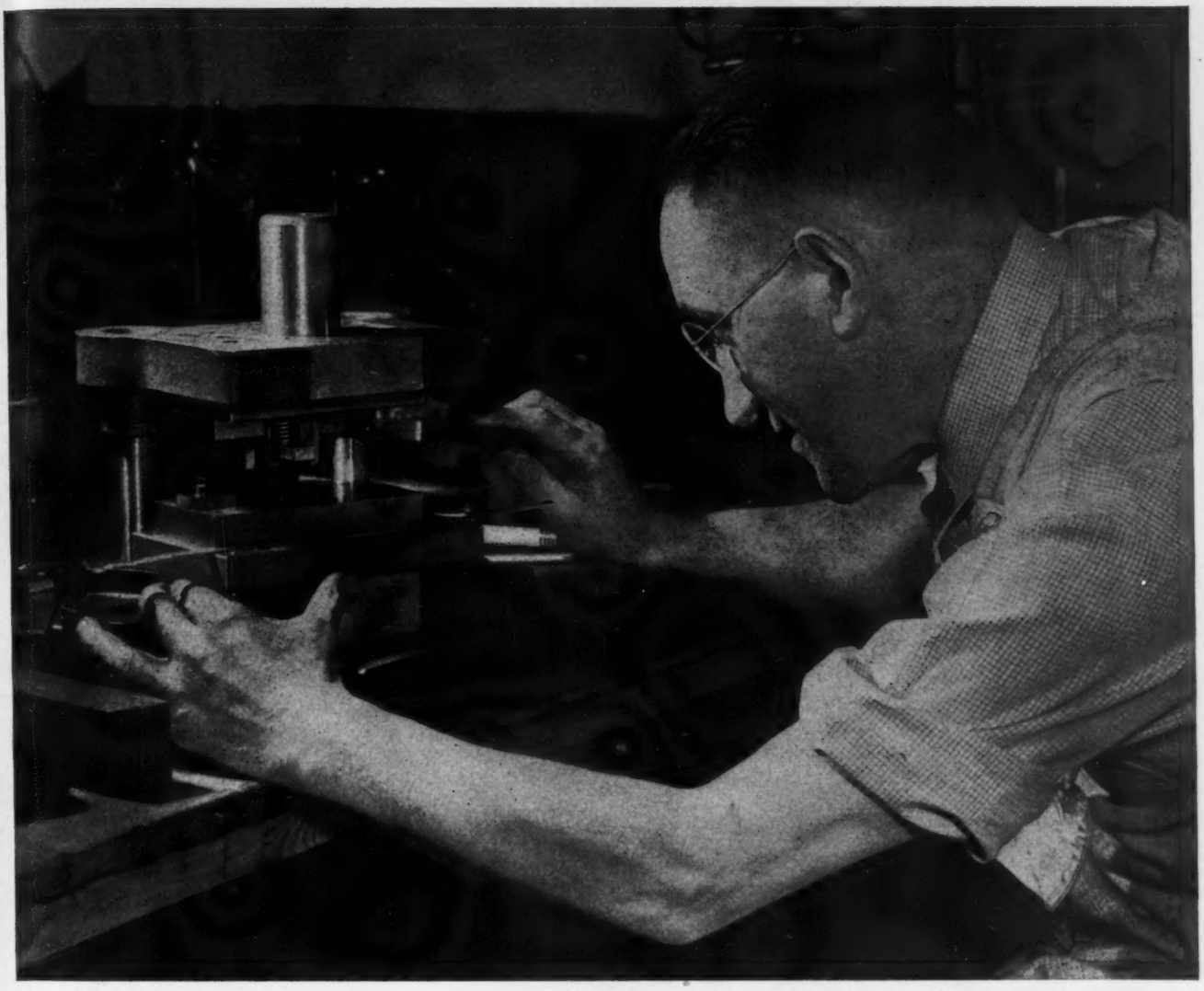
Telescore units, one of the latest electrical developments by the Brunswick-Balke-Collender Company, are being used, one for every two alleys. As the bowlers' scores are recorded, they are projected on a screen suspended from the ceiling as shown on the adjacent picture. This makes an ideal set-up for team matches because the spectators, as well as the bowlers, can be informed of the scores.

Automatic Foul Detector

Any chance for doubt in the bowler's mind as to whether he has fouled or not has been removed with the installation of automatic foul detectors using the electric eye. Photoelectric cells are installed close to the floor with a beam of light across the foul line. There is proper time delay so that a foul will not be recorded when the bowling ball breaks the beam of light. However, if the bowler's foot passes over the foul line it is impossible to get it back in time and a foul is recorded.

A combination electric heating and air conditioning system has been installed and Western Michigan bowlers are assured of ideal bowling temperature with proper humidity control during the warmer seasons.

Aside from the electrically operated features, no expense was spared in providing extra conveniences. New types of bowler's settees are in use and the latest models of "Safe-T-Ball Returns" have been installed. Even lockers in the restrooms are of specialized, modern design. The pin-setters



How Fred Bueschel came out of the dark!

FRED BUESCHEL makes dies in his own small die shop . . . one of thousands of shops producing vital war work on sub-contract. In die making where he frequently has to measure work to one ten-thousandth of an inch, he finds that fluorescent lighting is particularly helpful in following the pattern scratched on the metal before cutting. This line is so faint that it is practically invisible in poor or glaring light but is very visible under fluorescent lighting. His eyes used to get tired under the old light, but he is not bothered anymore. He says, "*It was just like coming out of the dark!*" Fred Bueschel's experience and thousands more like his should be told to every war plant in the country . . . especially smaller sub-contractors who urgently need better light to speed war production.

To assist in telling this important story of war production lighting to every large and small shop in the country, General Electric has prepared a comprehensive plan including a plan book, training material, a booklet on war production lighting, and a lighting salesman's handbook. The latter includes "before and after" photos illustrating 24 lighting bottlenecks and how to break them. Your General Electric lamp division has complete details on this plan and will be glad to discuss them with you.

G-E MAZDA LAMPS

GENERAL ELECTRIC

BOMBS OR SABOTEURS MAY NEVER REACH YOU... BUT ARE YOU *Ready?*

THE MASTER OF FLAME

duGas Fire Extinguishing Apparatus

Kills Fires in Seconds... Cuts Priceless Time from the Extinguishing Period

Where sudden, extra-hazardous fires endanger lives, valuable equipment, and threaten to halt the flow of vital power, *speed* is all important. Every second lost in killing a dangerous fire can mean hours and days lost in national Victory production.

DuGas—providing certain, *ready* protection and sure, *swift*, fighting action—is particularly effective on fires involving electrical equipment and fires in highly inflammable oils. DuGas stands guard today for utilities* in many parts of the nation.

** Names on Request*

duGas

DUGAS ENGINEERING CORPORATION • MARINETTE, WISCONSIN

Owned and operated by
ANSUL CHEMICAL COMPANY

Represented in Principal Cities

DUGAS FIRE EXTINGUISHING APPARATUS IS APPROVED BY UNDERWRITERS' LABORATORIES, FACTORY MUTUAL LABORATORIES

are masked in such a way that only the pins are seen by the bowlers. Pinboys are invisible, but a "one-way" vision installation permits them to watch the bowlers.

•

War-time Selling At San Diego

It's liquor versus appliances. Back of the policy of San Diego Gas & Electric Company to continue the promotion and even the sale of appliances and lighting is a realization of this fundamental local problem. For San Diego is a defense boom city with payrolls at an all-time high, new home and housing construction trying to keep pace with the influx of workers in the airplane industry. With such spending money, despite taxes and war saving bonds, if the working populace cannot furnish homes to live normally chances are that more of its money will be wasted seeking entertainment outside.

While the company desires to lean over backward in every effort to conform to the spirit and letter of WPB's curtailment, it does have this realistic picture of diversion of earnings to waste and destructive amusements facing it rather intimately. For that reason its advertising program, its promotion of dealer sales and its own selling efforts are keyed completely to nutrition, health, a better homelife, radio entertainment—all designed to maintain healthy morale and normal living.

Promotion

The Bureau of Radio and Electrical Appliances is the promotional organization for the region. Made up of dealers, distributors and the utility, it has the strong support of San Diego Gas & Electric. That support does not dominate the bureau, rather it implements it with the means to do its advertising and promotional work on a large scale. The bureau advertising does the appliance promotion job. The company's own space is devoted to educational material on nutrition, diet, repair of appliances to make them last, hints for savings in the use of appliances, and reminders of the economy of electric service.

First of a series of bureau promotions for 1942 was one on waffle irons. Offering a folder "Sixteen

Welcome Ways to Waffleize" the theme throughout was that of more usage from the family waffle iron. The folders were advertised with a catchy large-size advertisement over the bureau signature in the daily papers and publicized over radio spot announcements. To obtain copies, customers would call at dealers' stores.

There was no direct selling in the advertising. Rather, the thought was "If your waffle iron is out of repair, have it put in shape immediately." However, a statement indicated there were still some available in case a family did not own one. Definitely there was no "buy now" or scare appeal. Dealers are enthusiastic over this type of publicity which draws customers to their stores for the hand-out pamphlet.

Next was a refrigeration recipe booklet, again offered through dealers. Toasters will be next in line and then all appliances, both gas and electric, will be treated in turn along the same theme. From the first advertisement, over 500 phone calls and postals asking for the recipe booklet came in.

Institutional

To describe by interesting contrast the economy of electric service, some novel contests and promotions have been staged. First was a Punkawalla contest started last December, unfortunately, just before Pearl Harbor. A Punkawalla, it was explained, is a fan servant in India who may be employed for 10 anahs per day, an anah being about 2 cents. Comparison of the wage of a Punkawalla with the hourly wage of Reddy Kilowatt is made in the folder. The contest was built around the answers to ten questions on the entry blank.

Despite blackouts, the war, Christmas shopping and Christmas diversions, there were 1,537 total entries, and 307 contest finalists from November 7 to December 22. Preference in appliances were tabulated as follows: Radio, 567; refrigerators, 470; washing machines, 367; 100-watt lamps, 351.

The entire promotion was carried on by short plugs on the radio and a special fifteen-minute broadcast announcing the winners.

A new quiz contest has been started along similar lines. It is a "What a Watt?" which seeks to tell the story of electric supply, low cost of opera-

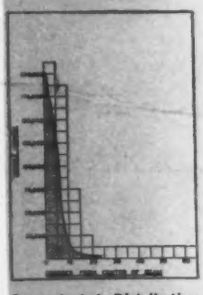
FOR WAR PLANT Production AND Protection

PERMAFLECTOR

Enclosed FLOODLIGHTS

Other War Uses

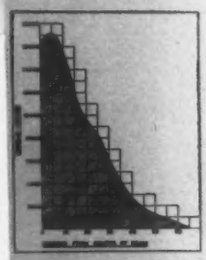
Airfields
Army Posts
Arsenals
Bridges
Construction Jobs
Dams
Docks
Mines
Pipe Lines
Power Stations
Railroad Yards
Substations
Viaducts



Concentrated Distribution Floodlights Numbers ST-1150-C, ST-1110-C. Addition of Stippled Cover Glass Provides Narrow Distribution.

Minimum of Critical Materials Used

★ Designed and built expressly for our vital war of production, these Permaflector floodlights project a flood of high intensity light which effectively serves to defeat the saboteur or to accelerate the output of war material. These new enclosed Permaflector steel floodlights are complete, ready-to-install and consist of a formed steel case equipped with hinge and clamps, heat-resisting cover glass, cast iron base, wire cord grip fitting, three-foot length of duplex wire, mogul socket and a 1,000-watt size Permaflector, the silver mirrored glass reflector which provides engineered light control from extreme concentration to extra broad spread. Preadjustment at the factory permits the use of 300, 500 or 750-watt lamps with the 1,000-watt size unit. Completely weather-proof and corrosion-resistant, these floodlights are ideal for all outdoor floodlighting applications. They may be mounted on a vertical or horizontal surface or attached to a pipe and adjusted to almost any position.



Broad Distribution of Floodlights Numbers ST-1050, ST-1010.

PITTSBURGH REFLECTOR CO.
403 OLIVER BLDG., PITTSBURGH, PA.

PITTSBURGH REFLECTOR CO. EW-5-42
403 Oliver Building
Pittsburgh, Pa.
Please rush complete data on Permaflector Enclosed Floodlights.
Name.....
Firm.....
Address.....

Lights that must not fail!

FINGERS of light stabbing the night, shooting upward thousands of feet—eyes that search the skies for unfriendly aircraft—paths of light that guide our protectors. These are the lights that *must not* fail! The responsibility for uninterrupted transmission and distribution can be placed only with electrical wires and cables as perfect and as trustworthy as modern manufacturing methods can make them.

The same vital responsibility rests upon the lines that transmit electrical power to factories, mills, railways, landing fields, highways, hospitals and homes. War production — civilian production — and life itself depend on unfailing transmission and distribution of electricity.

That is why American Steel & Wire Company engineers have worked for decades to improve the quality of electrical wires and cables. That is why they will continue to work unceasingly to see that the greater demands of the future will be met by still better products.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

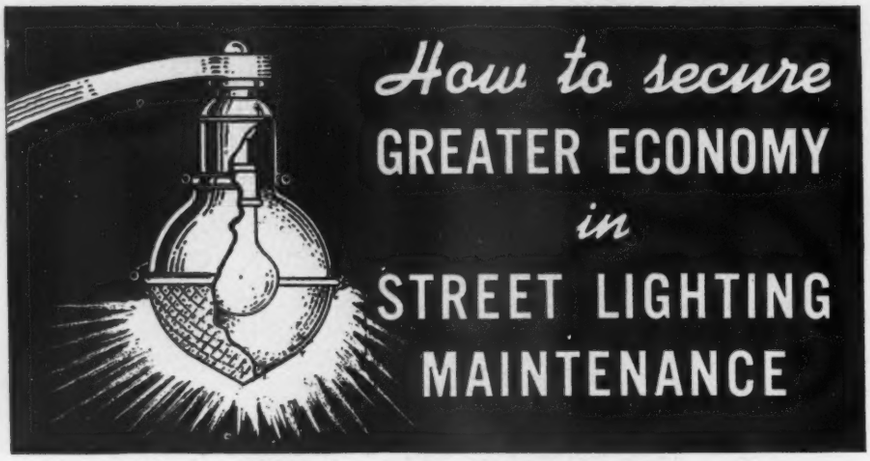
Columbia Steel Company, San Francisco, *Pacific Coast Distributors* — United States Steel Export Company, New York

ELECTRICAL WIRES AND CABLES

American Steel & Wire Company Electrical Wires & Cables are serving from coast to coast in the vital job of transmitting and distributing power and light. They are manufactured under the closest control, from the first operation to the last, and embody all latest improvements in design and construction.

UNITED STATES

S STEEL



How to secure GREATER ECONOMY in STREET LIGHTING MAINTENANCE

Replacement of the heart of the modern street light—the lamp—represents a substantial portion of the maintenance costs for an entire street-lighting system. Obviously, longer lamp life will reduce this replacement cost. The Slater Group Replacement type street lamp has been designed for such a purpose—to render efficient illumination economically and to give much greater life than the average lamp—proof on request. This *improved* lamp has been designed by specialists in street lighting and quality-produced by an organization noted for its special engineering facilities.

ENGINEERING COUNSEL

Our engineers are ready to help solve any street lighting problem without obligation. These men know how to find savings, short-cuts, and speed-ups in your lamp maintenance work. Their years of experience in lamp design and manufacture enables them to help you get longer lamp life and greater maintenance economies. Call on them at any time for free counsel.

SPECIAL DESIGN SERVICE

Our design engineers have an enviable record of specially-designed lamp installations—planned to meet definite voltage and burning-life specifications. One of the many jobs meeting strict performance standards under all conditions is shown below—a portion of the West Side Express Highway in New York City—completely Slater-equipped.

LABORATORY FACILITIES

An unusually complete set of laboratory equipment enables Slater engineers to render special design and testing service with economy of price. Our laboratory has been commended for its quality control and precision performance under production-line conditions.

USERS OF SLATER LAMPS

Slater Lamps are contributing to greater night safety and maintenance savings on thousands of miles of modern American highways. Cities and municipalities from Portland, Oregon to Providence, Rhode Island are using these lamps for traffic lights, street lighting, fire-alarms and other municipal highway uses. They use Slater lamps because of greater lumen output per square foot at less cost and longer life than the average lamp. Send today for complete details.

« LET US HELP YOU WITH YOUR LIGHTING PROBLEMS WRITE FOR FULL INFORMATION

Slater Electric & Mfg. Co., Inc.

Manufacturers of Street Lighting Lamps

728 ATLANTIC AVENUE BROOKLYN, N. Y.

tion of appliances, etc. Prizes of war savings bonds are offered to the winners.

While the company's own selling copy in the papers has disappeared, its stores continue to merchandise appliances and home-lighting equipment. Sales staff has been maintained, although replacements have not been made when any salespeople leave. To conserve rubber, field selling has stopped and home demonstrations and home service work is eliminated. Instead, cooking classes on nutrition and diet are conducted in the company's offices.

Throughout, the company's philosophy has been that to contribute to healthy and normal home living is an important aid to the war production program in which its community is so deeply involved.

•

Conserve Appliances in Eastern Oregon

With no more appliances available and with appliance business among dealers falling off abruptly since January first, Eastern Oregon Light & Power Company, Baker, Ore., has entered upon an energetic newspaper campaign in its territory to educate the public on the up-keep of all existing consumer appliances and also their intelligent use. Since there can be no load increment in this direction for an indefinite period of time, the company feels that to hold all of this type of load now on the lines is a matter of No. 1 importance.

L. G. Gray, division manager, advises that there are six local newspapers in towns served by the company and that the advertising space carried is 12 inches, two or three columns. From now on every housewife must hold in mind that every one of her electrical appliances should be kept in first-class, workable condition, through the services of the repair departments of the electrical dealers. She must learn to take stitches in time in this respect.

At the same time, she will be encouraged to practice economy in the consumption of energy. In fact, by exercising care and judgment in her cooking operations she can do much the same thing in their case that 40 miles an hour does for tires and gas consumption in the case of automobiles.

SAVE TIME—ELIMINATE TROUBLE—ASSURE STRENGTH—SPLICE HIGH STRENGTH STEEL CONDUCTORS THE EASY, DEPENDABLE WAY . . .

Nicopress Galvanized Steel Sleeve and Completed Splice

Do the Jobs with Nicopress STEEL SLEEVES

The Nicopress method of splicing "80" and "130" High Strength Steel Wire eliminates all chance of bad line joints, greatly simplifies the splicing jobs and assures splices that can be relied on to deliver long, trouble-free service.

NICOPRESS TOOL for compressing Steel Sleeves Length of tool 35"

Neat joints are quickly made by any lineman with these Galvanized Steel Sleeves and an easy-to-operate Nicopress Tool. The splices are tight, exceed the rated breaking strength of the conductors, and have a lasting high conductivity.

Nicopress Galvanized steel sleeves are available for 4, 6 and 8, B.W.G. solid or 3-wire strand.

Because of the economy, saving of labor and time, the Nicopress method of splicing steel conductors is unsurpassed.

ORDER "NICOPRESS" STEEL SLEEVES FROM YOUR JOBBER TODAY.

●

THE NATIONAL TELEPHONE SUPPLY COMPANY

Manufacturer of Specialties for Power and Communication Lines

5100 SUPERIOR AVENUE • • CLEVELAND, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

NEW EQUIPMENT

Luminaire

New vapor-tight luminaire for high or low areas has porcelain-enameled steel reflector available in several sizes, a socket assembly,

"Millite" luminaire; reflectors for 300- to 1,000-watt lamps. **Westinghouse Lighting Division**, Edgewater Park, Cleveland, Ohio.

and a ¼-in. hinged glass cover. Unit is arranged for conduit mounting and is said to be suitable for outdoor applications. Incandescent or mercury lamps may be used.

•

Plug-In Duct

"Saflex" plug-in duct; 250-, 375-, 500-, 750- and 1,000-amp.; 2- and 3-wire single-phase, 3-phase and 4-wire service. **Square D Co.**, Switch & Panel Div., Detroit, Mich.

Six openings are provided in each 10-ft. length of this plug-in duct to accommodate 12 plug-in units. Tubular or solid round buses are enclosed in steel housing.

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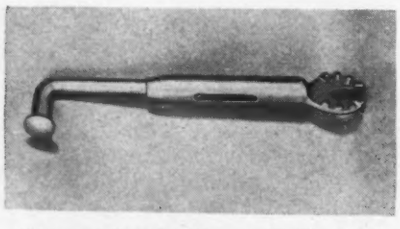
Line Tools

Recent line tool developments of this manufacturer include a "snap-out disconnect" device for opening disconnect



"Universal Snap-Out Disconnect" (illustrated) and "Enclosed Cutout Tool". **A. B. Chance Co.**, Utilities Div., Centralia, Mo.

switches and cutouts and a tool for handling enclosed fuse cutouts. Cutout tool has rubber-covered jaws and screw head to protect porcelain; turning the pole to which the device is attached closes jaws firmly on cutout door. With the disconnect tool, a hammer blow may be given to the pulling ring of the disconnect or cutout. Pulling ring is engaged; pushing upward on the tool compresses the spring in the device. Jerking downward opens the disconnect.

•

Bus-Drop Cable

"Flamenol" bus-drop cable for 600-volt branch circuits. **General Electric Co.**, Schenectady, N. Y.

Nonrubber flexible bus-drop cable is announced for connection from bus to machine. One end of cable is inserted into knockout of plug-in box of bus system with a squeeze-type fitting; cable is then run horizontally to point above machine—no conduit being needed. At machine, cable is looped through and supported by porcelain spool insulator connected by spring to supporting wire. Cable then drops, terminates at switchbox of machine tool. Conductors are stranded copper, protected by tin coating or other suitable material.

•

Gate Operator

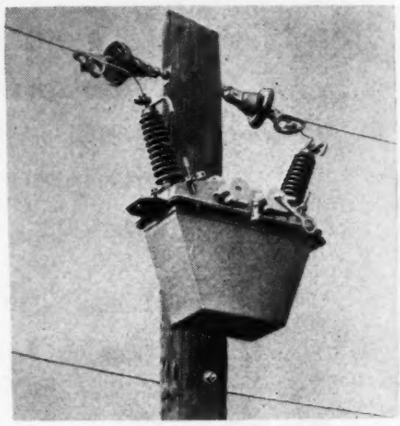
Electric gate operators; Models "MC" and "MR"; complete motor unit consists of motor, centrifugal clutch, magnetic brake, speed reducer, hand release and limit relay or limit switch. **Barber-Colman Co.**, Rockford, Ill.

Application to plant protective systems is a potential use of electric gate operators designed to open and close sliding or sliding abutting gates. Operator is furnished in two models. One type is controlled from a momentary-contact three-button station. The other has a safety feature that requires constant pressure on the "close" button during the entire closing cycle. Driving motors are of the three-wire instantaneously reversing type; 110, 220 or 440 volt single- or 3-phase. Size varies from ⅛ to ¾ hp., depending on size of gate to be controlled.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Service Restorer

For clearing immediately any number of transient faults and automatically restoring service on rural distribution branch lines



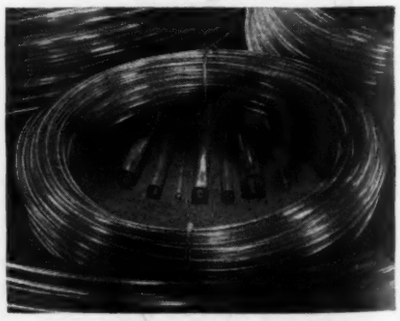
Single-pole motor-rewound automatic service restorer; 15-kv., 50-amp., 1,000-amp. interrupting. **Pacific Electric Mfg. Corp.**, Gary, Ind.

and feeders, this single-pole automatic service restorer is actuated by a motor-wound spring. It has adjustable time and current settings for consistent coordination with other equipment. Manual operation is provided; all parts are enclosed and operate under oil.

•

Plastic Tubing

New seamless tubing extruded in continuous lengths is said to be virtually un-



"Tenite" tubing; transparent; sizes up to ½ in. diameter and wall thickness of 0.035 in. available in long-length coils; over ½ in. diameter available in 12-ft. lengths; 1-in. diameter available shortly. **Julius Blum & Co., Inc.**, 532 West 22d St., New York, N. Y.

A BETTERMENT . . .

Not a Substitute

What manufacturer who has turned from slow, heavy riveting construction to modern, high-speed, light, dependable welding would want to turn back to riveting.

This development in production practice has crystallized so fast it might even be called a revolution.

Ship, tank, and other structural steel-makers, who yesterday were using riveting, are today staunch supporters of welding.

In almost as short a time Continental-Diamond NON-metallics have replaced many habitually used heavy—corrosive—costly materials. Likewise these new users of C-D NON-metallics will not want to go back to the replaced materials . . . even when they become plentiful. The reason . . . C-D NON-metallics are doing a better job—they have lightened weight, increased life, speeded up production, provided for the welfare and protection of workers.

There will be few who return to riveting and still fewer who will give up the "betterments" achieved when C-D NON-metallics are properly designed into their products.

The C-D booklet will give you basic data on FIVE C-D NON-metallics. When writing for it, ask for Booklet GF-12. Then, when you are ready to discuss your particular problem . . . write, wire or phone for a C-D Laboratory Research Representative.

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

Mitchell-Rand ELECTRICAL INSULATING MATERIALS

for trouble-free operation *everywhere* in the plant

Here is just a brief outline of Mitchell-Rand Products

CABLE FILLING AND POTHEAD COMPOUNDS: "Rubberseal" type plastic compounds for filling joints in rubber, varnished cambric, or paper-insulated cables; generally recommended for 600-volt services and higher; proof against acids, waterproof and alkali-resisting; excellent adhesive properties; extremely flexible.

FIBERGLAS SATURATED SLEEVINGS AND TUBINGS have an inorganic fibre glass base particularly designed to meet the needs of the electrical industry. Maximum flexibility and long life are insured through careful braiding of continuous filament glass yarn, thoroughly impregnated with a long oil flexible baking varnish. Particularly resistant to high temperatures, moisture, oils and acids.

FIBERGLAS STANDARD SLEEVING is treated with the minimum amount of varnish that will prevent fraying; recommended for high temperature conditions where dielectric strength is not a factor.

DOUBLE SATURATED SLEEVING is basically the same as Standard Sleeving, but additional insulating varnish raises its dielectric rating to 1500 volts average.

TRIPLE STRENGTH SLEEVING: a specially built up wall of flexible insulating varnish insures a minimum dielectric test of 3000 volts.

IMPREGNATED VARNISHED TUBING has a dielectric strength over 8000 volts, is non-hydroscopic, resists high temperatures, oils and acids. Recommended for use where long life under severe conditions is required.

Made in **Tapes** .003" to .015" thick; ⅜" to 1½" wide, any length; **Cloth**, .002" to .023" thick, 38" wide, any length; **Sleeving**, 1/16" to ½" I.D.; **Tying Cords**, 1/64" to ⅛"; also as **Varnished Tape and Cloth**, and in **Mica-Flexible Type; Varnish Saturated Sleeving**, Size No. 20 to ⅝".

COTTON SLEEVINGS: Untreated; white and colored; Size Nos. 00 to 13.

COTTON TAPES AND WEBBINGS: **Tapes:** .005" Thin, Lightweight, and .007" Standard, linen finished, ½" to 2". **Webbings:** Nonelastic and Special Surgical Types, ¾" to 2".

FLEXIBLE VARNISHED COTTON TUBINGS: Made in Double Varnish and Triple Strength Saturated Sleeving, and MIRAC and HYGRADE Varnished Tubing; Size Nos. 20 to ⅝". Double Varnish Sleeving is seamless woven of long staple fibre yarn, saturated with high grade insulating varnish, and baked slowly. Triple Strength is same, except has additional coats of varnish. MIRAC Tubing is given an initial clear impregnation, then a thick insulating coat. HYGRADE Tubing is highest quality, meeting A.S.T.M. specifications.

Skilled engineering advice and service to meet your special specifications

TRANSFORMER COMPOUNDS: No. 2348: Black, flint-hard potting compound; melts at 230° F.; pours at 390° F.. **Dry Battery Seal:** Hard, cement-like sealing compound; excellent for power, audio or neon light transformers. Also, **"Stick" Seal, Chatterton Compound**, and other filling compounds.

WRITE *for complete* GUIDE BOOK *of INSULATING MATERIALS*

MITCHELL-RAND
51 MURRAY STREET

INSULATION M-R COMPANY

INSULATION CO.
NEW YORK

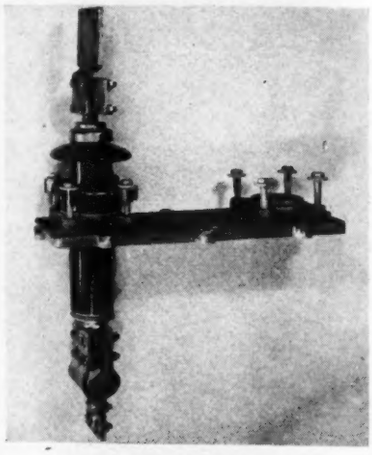
Telephone: Cort. 7-9264

breakable and may be readily bent, formed or curved to fit almost any condition. Ends may be adjusted to standard flared fittings with some tools used for copper tubing. Large diameter tubing, with wall thickness of 0.0625 in., may be threaded with standard thread-cutting tools.

•

Bushing

New heavy current bushing features flexible connector of laminated copper at bottom of bushing stud designed to relieve any stress on porcelain insulator caused by the expansion and contraction of the heavy coil leads due to heating and cooling. Connector and terminal are clamped to copper



Heavy current bushings; 500 to 3,000 amp. ratings; 1,000-amp. bushing with brass slot cover illustrated. **Pennsylvania Transformer Co.**, Pittsburgh, Pa.

rod, but insulator is not permanently fastened to the rod or to the mounting flange—an aid to easy insulator replacement if it is damaged during transportation or installation. Same porcelain is used throughout the five standard ratings.

•

Name Plates

"Kum-Kleen." **Avery Adhesives**, Los Angeles, Calif.

As a substitute for metal name plates, identification and instruction tags, this company offers a product that will adhere to any smooth surface and is applied without moistening. Company states it will adhere even when exposed to high temperatures or changing climatic conditions.

•

Coaxial Cable

High-frequency cable: solid type insulation. Suitable for communication, control and test equipment. **Simplex Wire & Cable Co.**, Cambridge, Mass.

A new type of coxial cable is said to meet severe military requirements for high-frequency, low-loss operation. Central conductor is insulated to a suitable diameter with recently developed low-loss dielectric, covered with copper braid to serve as a concentric outer conductor. Entire assembly is protected by a Simplex-Plastex jacket. It is said to be flexible, easily installed, usable on the highest radio frequencies, moisture-proof and free from internal condensation. This type of material should stimulate research and development for future application in other than communication fields, such as the light and power industry.

NEWS ABOUT PEOPLE

Broader Duties Assigned to Boston Edison Men

Sumner R. Keyes, purchasing agent of the Boston Edison Co., has been appointed assistant vice-president, reporting to Leavitt L. Edgar, vice-president in charge of procurement, service and supply. John A. Herlihy, superintendent of the service and supply department, has been similarly designated and will also report to Mr. Edgar. John J. Buckley, superintendent of the public relations department, has been made assistant vice-president, reporting to Thomas H. Carens, vice-president in charge of public relations. Mr. Keyes has completed 37 years with the company, Mr. Herlihy 28 and Mr. Buckley 40 years.

•

▶ GANO DUNN, president of the J. G. White Engineering Corp., received the honorary degree of doctor of engineering from Lehigh University at the recent commencement exercises.

▶ J. PAUL CLAYTON, chief system officer, Commonwealth Edison Co., received the honorary degree of doctor of engineering from Tulane University, New Orleans, La., at the annual commencement exercises. Mr. Clayton was graduated from Tulane in mechanical and electrical engineering in 1909.

▶ SAMUEL FERGUSON, JR., manager of the New London division of the Connecticut Power Co., has been appointed assistant to the president. Mr. Ferguson will continue as assistant treasurer of the company. He was assistant to the manager of the Housatonic division from 1932 to 1937, following a connection with the Stone & Webster interests in Boston, Richmond and New York, and was made manager in New London in 1937. JOHN J. DOWLING, operating manager of the New London division since 1937, has been appointed manager. Mr. Dowling is a chemical engineering graduate of Rhode Island State College and was connected with Stone & Webster in New England and Louisiana until 1923, when he was appointed superintendent of power and gas engineer for the Connecticut Power Co., being promoted to his recent post in 1929.

•

Pacific Power Promotes Roach and McCurrach

Two key personnel moves by the Pacific Power & Light Co. were recently announced by George T. Bragg, vice-president and general manager. T. E. Roach, assistant to the president, will

T. E. Roach

be transferred from Yakima, Wash., where he has been in charge of the company's Washington division, to the Portland office to assume broader responsibilities connected with wartime system operations. Assigned to the Washington division headquarters to succeed Mr. Roach is D. F. McCurrach.

Before going to Yakima to supervise and co-ordinate the operations of the Washington districts under the direction of Mr. Bragg, Mr. Roach was president of the Washington Gas & Electric Co., Tacoma.

Mr. McCurrach, who has been with the company for a number of years as an engineer and rate man in the Portland office, has been made assistant general manager, in charge of the Washington division.

•

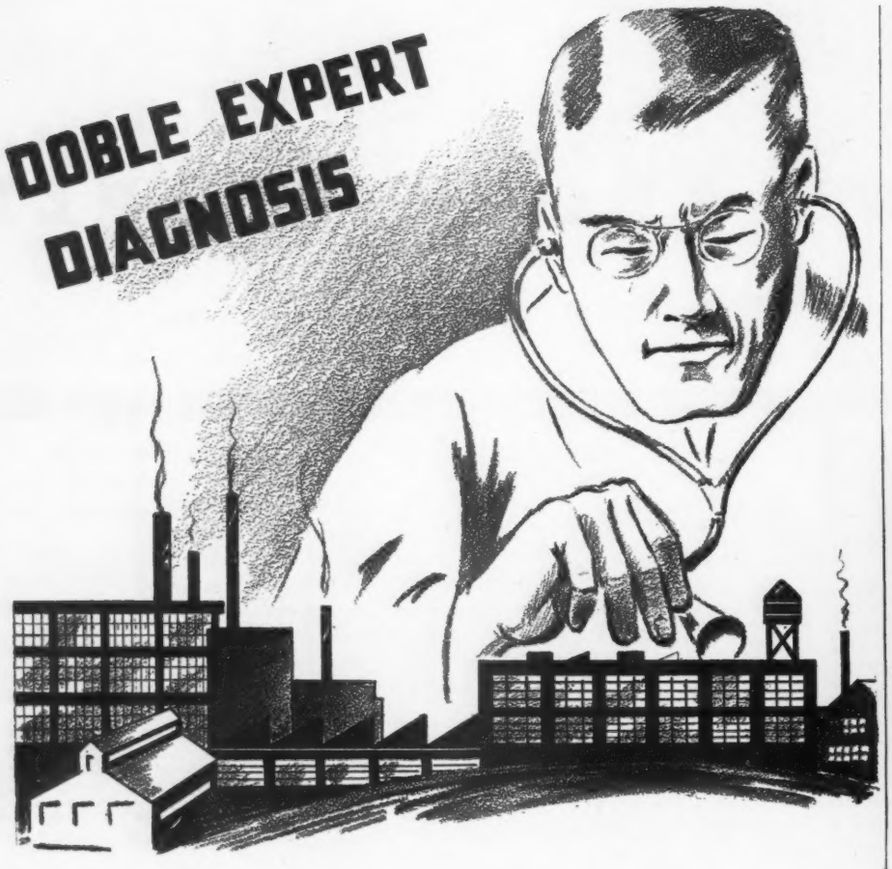
▶ CHARLES E. WILSON, president General Electric Co., has been elected to the board of directors of the American Arbitration Association.

▶ HENRY G. RITER, 3d, senior partner of Riter & Co., was elected chairman of the board of directors of the Copperweld Steel Co. at a meeting of the board of directors held recently in Pittsburgh. A director of the company since 1939, he succeeds WILLIAM K. FRANK, who resigned to serve on the War Production Board.

▶ MARVIN LEE, chief engineer Burndy Engineering Co., Inc., has been elected acting general manager by the board of directors to fill the vacancy caused by the enlistment in the U. S. Air Corps of CAPT. BERN DIBNER, a founder of the company and for almost 20 years its vice-president and general manager.

▶ B. W. CREIM, assistant chief engineer of the Bonneville Power Administration, has reported to the U. S. Navy for active duty. WALTER KANZLER, chief construction engineer of the Bonneville administration, will succeed Lieut.-Commander Creim as acting assistant chief engineer and VERNE TAYLOR, chief of the substation construction unit, will become acting chief of the construction section for the project.

▶ WILLIAM N. CUMMINS, JR., manager of the Hopewell office of the Virginia Electric & Power Co. for the past three years, has been transferred to Norfolk, where he will be assistant to R. J. Throckmorton, vice-president of the company. Due to war conditions, Mr. Cummins will not be replaced in Hope-



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stands at the heart of the war effort!

Prevent Critical Breakdowns

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DOBLE TESTS

Make Electrical Equipment Last Longer!

Vital in war industries, the standard Doble Electric Insulation Service, backed by 21 years of experience, is increasing in its application. In addition, the Doble laboratory is carrying on essential engineering research, development and consultation in combat communications and electric power.

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MEDFORD HILLSIDE, BOSTON, MASS.

well at this time. DAVID T. EARLY will have charge of the local office and handle all company business. Mr. Early has been connected with the Hopewell office for a number of years.

•

Will Handle Procurement for Crocker Wheeler Co.

Wallace K. Brown has been appointed vice-president in charge of procurement for the Crocker Wheeler Electric Manufacturing Co. His new responsibilities include co-ordinating

and expediting all the related functions of the procurement and purchasing departments. Mr. Brown started with the Crocker Wheeler organization as an apprentice engineer in 1908 after completing his technical training at Clarkson College of Technology and the University of Illinois. Since then he has been district manager in San Francisco and Newark and eastern sales manager in New York. He was elected vice-president and appointed general sales manager in 1938. Mr. Brown is located in the company's executive offices at Ampere, N. J.

▶ ARTHUR W. WEEKS, for the past 21 years with the Boston Edison Co. and supervisor of the standardizing division of its laboratory, has been appointed superintendent of the Mico Instrument Co., Cambridge, Mass. RUSSELL C. GHEN has been named to fill Mr. Weeks' former position with the Edison company.

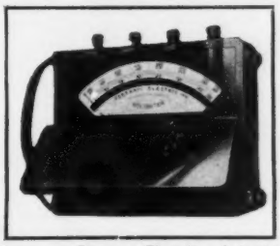
▶ O. M. JACKSON, sales promotion manager, Georgia Power Co., Atlanta, has been named deputy regional director of the War Production Board in the Southeast and has been granted a leave of absence by the utility company so that he may devote his entire time to the work. A native of Atlanta and a graduate of Oglethorpe University, Mr.

To the unfamiliar man on the unfamiliar job

IF YOU are the "unfamiliar man" . . . if YOU are confronted with complex problems in the operation and maintenance of electrical equipment, due to the speed-up of War Production . . . if you've got to perform miracles of overhauling and rehabilitation with your own resources . . . not only you, but even old experienced electrical men can possibly be stumped by today's unfamiliar problems and conditions. Yes, you're up against it . . . UNLESS you've got the right equipment to make certain simple tests, remedy certain conditions in electrical apparatus and wiring.

It doesn't need expert training or long experience to pick such "tools" or to use them in ways you may have never before realized! Here are four essentials to help you in such work—all ready for *prompt delivery*. These suggestions only scratch the surface—suggest a few of many possibilities! More detailed helpful literature sent upon request. Also, we will be glad to answer any further questions that may arise on your job along these lines. Don't hesitate to write Ferranti for *cooperation without obligation*.

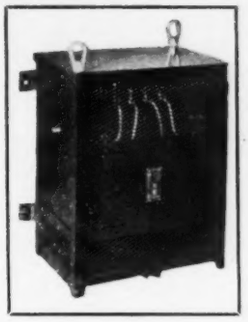
FERRANTI
HIGH ACCURACY
PORTABLE VOLT METERS



Invaluable for detecting low voltage troubles on flourescent lighting systems. Testing with Portable Volt Meter across line, lamp or various elements of ballast indicates variation from normal operation.

Also determines voltage loss on Power Circuit: detects presence of economic waste due to inadequate capacity. Another use—to check wiring of machines, by maker and user: and to make "continuity tests," i.e. to tell whether circuit is complete.

FERRANTI AIR COOLED
INDUSTRIAL TRANSFORMERS



For low voltage in extension cords in dangerous places. With air cooled industrial transformers, high voltage can be stepped down to 6, 12 or 20 volts.

For extensions from power circuits for lighting, reducing 440 to 110 or 120 volts on a 3-wire general lighting system, or reduce 230 volts to 120 volts for local lighting around machines. Also for stepping up voltage at the end of a long line.

FERRANTI LOW COST
CLIPON AMMETER

Reads current without opening circuit, checking broken connections or loose connections, especially in multiple feeders. Exposes conditions of unbalance on 3 phase circuit, where 3 wires should be balanced. Also for testing multiple-conductor-leads to motor. Important in connection with recent N.E. Code provision covering paralleling of conductors. A current test with a Clipon Ammeter is a good indication of load on a motor.

FERRANTI
PHASE ROTATION INDICATOR

1. Will establish a standard of phase rotation at panel board terminals in a wiring system.
2. Will indicate proper phase rotation of a motor circuit before motor is put on line, enabling adoption of a standard phase rotation, so motors will always operate in the same direction.
3. Will help in polarizing 3 point plugs to which portable motors are connected.

For Quick Deliveries of Quality Products

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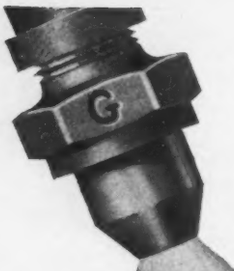
NEW YORK, N.Y.



Five-Second
OIL FIRE KILLER!

Before any major fire-damage can occur in transformers, turbines or other oil-filled equipment, a fixed Mulsifyre System will stop the fire in its tracks.

Mulsifyre Systems operate on the unique principle of mulsifying blazing oil with a driving spray of water. The instant water is turned on (either manually or automatically), high-velocity water-spray blankets the oil... churns the surface into a non-flammable emulsion... positively stops fire within 2 to 5 seconds!

GET FULL DETAILS. Write for Authoritative Data Book on Mulsifyre Systems by Underwriters' Laboratories. Grinnell Co., Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities of the United States and Canada.

GRINNELL
MULSIFYRE
Fire Protection Systems

Jackson has been with Georgia Power for sixteen years and was at the time of his appointment to the WPB in charge of developing new-business activities.

•

West Coast Appointments Announced by G.E.

C. R. Owens and R. W. Steenrod have been appointed welding specialist and industrial heating specialist, respectively, of the General Electric Pacific District. E. J. Cipperly will continue as industrial heating and arc welding specialist at the Los Angeles office.

Simultaneously the appointments of A. D. Boardman as Pacific district industrial control specialist, and L. E. Donahue as industrial control specialist at the Los Angeles office were announced. Mr. Owens has been with General Electric since 1923 and Mr. Steenrod since 1933. A graduate of Stanford University, Mr. Boardman joined General Electric in 1927 and Mr. Donahue in 1937.

•

New Appointments Made by American Steel

Francis J. Burtt has been appointed director of industrial relations of the American Steel & Wire Co., Cleveland, Ohio, to succeed E. W. Kempton, who has been transferred to the U. S. Steel Corp. of Delaware. Mr. Burtt worked for the McIntosh Hemphill Co., Duquesne Light Co. and the Pressed Steel Car Co. before joining American Steel & Wire in 1927. In 1937 he was made foreman in the electric welding and field fence department, the following year was appointed superintendent of wire and wire products at the Donora Steel & Wire Works and last year was transferred to Cleveland as assistant director of industrial relations.

Four changes in the metallurgical and research departments were recently made. John S. Richards has been appointed director of research and will be succeeded as manager of the metallurgical department by James R. Thompson. Flint C. Elder, whom Mr. Richards succeeds, has been named research engineer on special assignments for the vice-president. Lawrence H. Dunham has been made assistant manager of the metallurgical department to succeed Mr. Thompson.

Arthur W. Davis, since 1938 treasurer and director of the Electric Household Utilities Corp., Chicago, Ill., and its subsidiary companies, has been appointed comptroller of the company.

A. F. Allen is retiring as secretary-

Know What's UNDER the Trade-mark Before You Buy MOTORS!

PROUD as we are of the Fairbanks-Morse trade-mark, we urge that before buying you look beyond the trade-mark—*look at the motor.* For we know, and you know, that it's the motor and not the trade-mark that runs machines.

And because we believe you know motor quality when you see it, we ask you to look at the construction of an F-M Motor point by point. Compare the exclusive F-M Copperspun Rotor, for instance, with the rotor in any other squirrel cage motor. You'll say, we're sure, that you want windings centrifugally cast of COPPER, rather than of some less suitable metal.

Would you like to look further into the construction advantages that give F-M Motors their proved stamina? A post card or telephone call will bring you a demonstration. Fairbanks, Morse & Co., Dept. E-27, 600 S. Michigan Ave., Chicago. Branches and service stations throughout the United States and Canada.

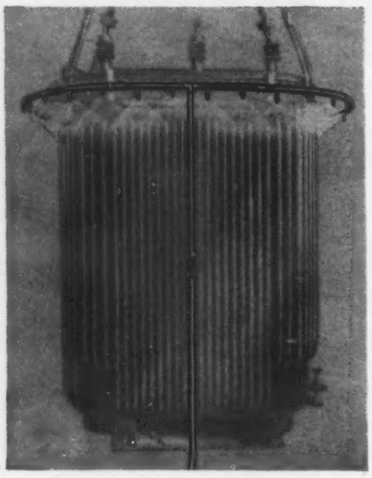
Copperspun
Patented

FAIRBANKS·MORSE MOTORS

DIESEL ENGINES ELECTRICAL MACHINERY MAGNETOS RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS MOTORS FAIRBANKS SCALES WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

HERE'S HOW

you can increase Capacity of your present Power Transformers



Use BROOKS SPRAY RINGS

Transformers equipped with Brooks Spray Rings are delivering 60% or more over rated capacity without injury of over-heating.

This unit is easy to install and operate—efficient—low cost—frostproof—self draining.

Here's Proof —

We have actual performance tests that prove conclusively that existing capacity can be increased appreciably with Brooks Spray Rings.

Get the facts—convince yourself of the many advantages—and the ease and low cost of obtaining increased transformer capacity.

JOHN A. BROOKS SPRINKLING SYSTEMS

Patented Sprinkling Devices Since 1915

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Please send me Test Sheets containing data on actual tests showing method of tests—results of temperature tests—water data and discussion of results.

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.....

treasurer of the company. With more than 52 years of service with subsidiary companies of the U. S. Steel Corp., Mr. Allen's association with the wire company dates back to the year of the formation of that company—1899. In 1901 he was elected secretary and in 1928 treasurer.

▶ HARRY L. ERLICHER, vice-president of the General Electric Co. in charge of that company's purchasing activities, was elected president of the Purchasing Agents Association of Eastern New York at the recent annual meeting held in Schenectady, N. Y.

▶ MARSHALL WILSON, electrical engineer with the Springfield (Ill.) water, light and power department, has resigned to become senior power engineer with the B. F. Goodrich Co., Akron, Ohio. Mr. Wilson has been assistant to S. J. Sibley, superintendent of the city electric department, for several years and supervised much of the construction and installations of equipment at the Lake Side electric generating station.

▶ CARLTON L. DUDLEY, formerly division superintendent, Camden area, Public Service Electric & Gas Co., Newark, N. J., has been appointed division superintendent, Essex division, succeeding Arthur R. Nelson, who has been promoted to assistant general superintendent of distribution. GEORGE P. SIMMEN, formerly division superintendent, Trenton area, has been made division superintendent, Camden area, replacing Mr. Dudley and PERCY B. BASS, formerly assistant division superintendent, Hudson division, has been made division superintendent, Trenton area, succeeding Mr. Simmen. WILLIAM A. GUESS, who has served as installation engineer, general office, has been named assistant division superintendent, Hudson division, replacing Mr. Bass.

▶ DONALD W. RANDOLPH has been appointed director of research of the Apex Electrical Manufacturing Co., Cleveland, Ohio. Mr. Randolph's experience includes positions as research engineer, General Motors Corp.; chief electrical engineer, Aviation Engine Division, Packard Motor Co., and assistant mechanical engineer, U. S. Bureau of Standards. Mr. Randolph is active in the American Society for Testing Materials.

▶ HENRY CZECH of Milwaukee, manager of the northern district of the Westinghouse Electric Supply Co., has been appointed manager of the Northwestern district with headquarters in Chicago. Mr. Czech succeeds JOHN H. FISHER, who has been named general manager of the company. Mr. Czech has been in

NO MAGIC —ABOUT THE LONG LIFE THAT MOTOR USERS GET WITH WESTINGHOUSE CS MOTORS— SIMPLY SEALED SLEEVE BEARINGS.

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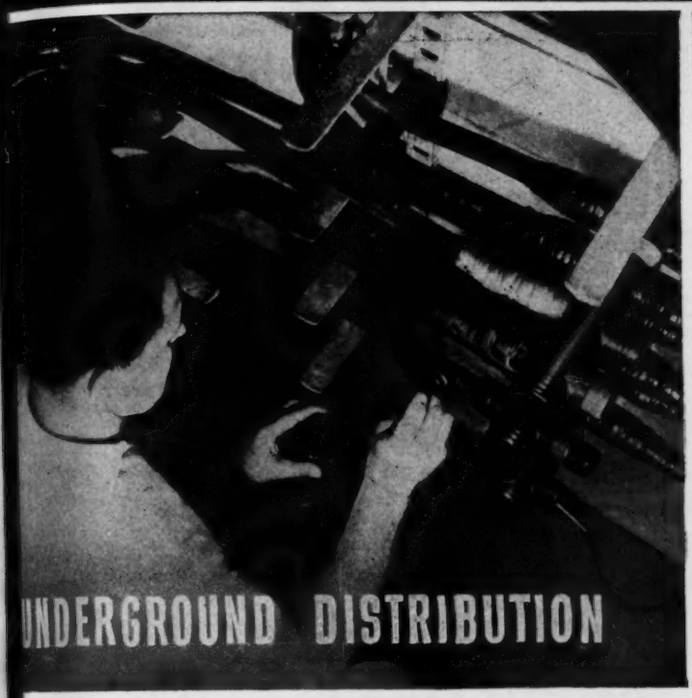
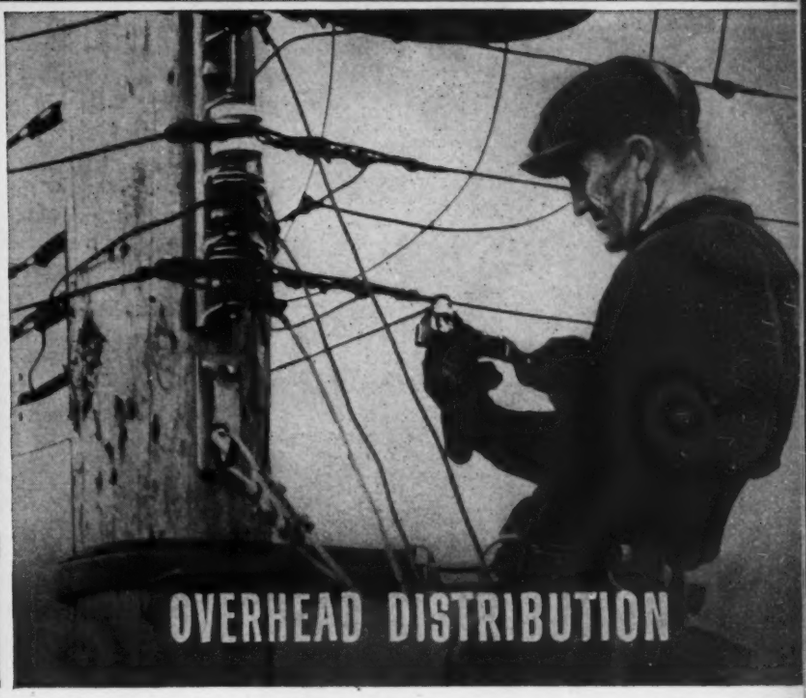
J-21234-A

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

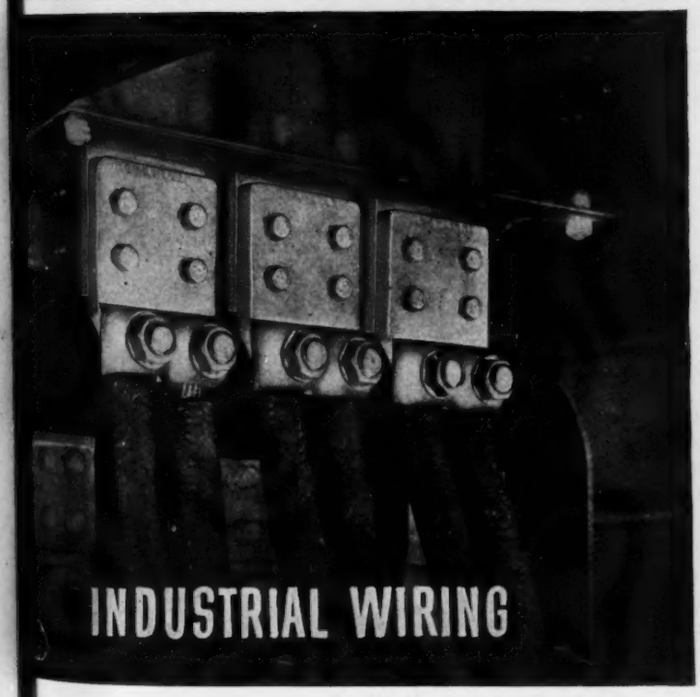
FOR CONNECTORS CONSULT THE SPECIALIST— *Burndy*



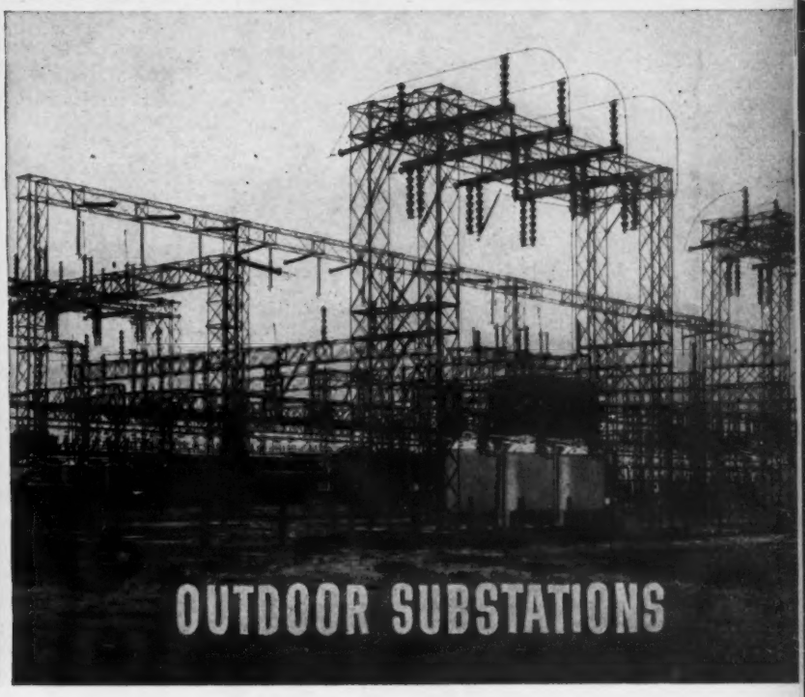
UNDERGROUND DISTRIBUTION



OVERHEAD DISTRIBUTION



INDUSTRIAL WIRING



OUTDOOR SUBSTATIONS

How to Choose the RIGHT Connector for Every Application

Choosing the right electrical connector is an easy job in this age of specialization. For Burndy Engineering Co. has been designing connectors *exclusively* for almost 20 years, and part of the service they gladly render is passing their experience, their wealth of accumulated test and performance data along to you.

So be sure you're getting *all* the advantages you're entitled to in a connector by specifying Burndy. Our factory is always on call for assistance. A Burndy specialist located near you will respond immediately to your request for information.

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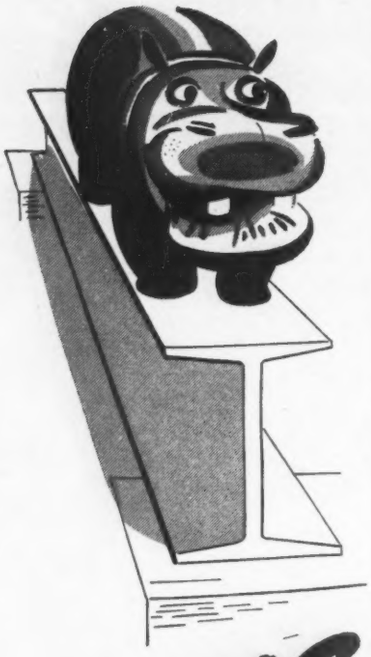


NO SAG —IN RIGID, ONE-PIECE, WESTINGHOUSE CS MOTOR FRAMES!

... JUST ANOTHER POINT WHERE THEY'RE YEARS AHEAD!

J-21233-A

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

the electric supply business for 29 years. He is a member of the Wisconsin Utilities Association, Wisconsin Municipal Utility Association and is a past-president of the Electrical League of Milwaukee and the Wisconsin Refrigeration, Radio and Appliances Association.

▶ WILLIAM M. BAILEY and PAUL MCKNIGHT DEELEY have been elected vice-presidents of the Cornell-Dublier Electric Corp. Both men have been associated with the company since its formation.

▶ H. M. PATTERSON, district engineer, sales division, Anaconda Wire & Cable Co., New York, has been transferred to the company's Atlanta office as district engineer. Mr. Patterson was formerly electrical engineer, Copper Wire Engineering Association, Washington, D. C.

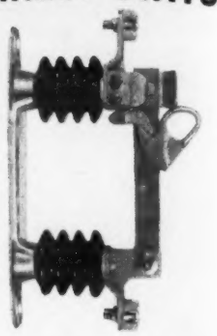
▶ LUCIEN E. MESSINGER, president of Canadian Line Materials, Ltd., Burlec, Ltd., and Wired Radio of Canada, Ltd., of Toronto, Canada, subsidiaries of Line Material Co., Milwaukee, has been made assistant to Donald Gordon, chairman of the War Time Trade and Price Board of Canada. Mr. Messinger is well known in the electrical industry in the United States. He has been president of the Canadian organizations since 1929.

▶ HARRY A. EHLE, formerly manager of the industrial division of the International Resistance Co., Philadelphia, Pa., has been made a vice-president of the company. HAROLD G. BEEBE, formerly assistant manager of the division, has been made manager of that division, which now handles a large part of the company's government business.

▶ DR. GEORGE RUSSELL HARRISON, internationally known physicist and spectroscopic research authority, has been appointed dean of the school of science at the Massachusetts Institute of Technology, succeeding Dr. Samuel C. Prescott, who retires July 1. Dr. Harrison joined the institute's staff in 1930 to take charge of the newly opened spectroscopy laboratory, which under his leadership has become an outstanding world center for the study of light as emitted by atoms and molecules. Besides being director of the above laboratory he is professor of physics. For his contributions to research he was a Rumford Medalist in 1939.

▶ H. C. CLEMENT has been appointed assistant to the district manager of the New York district of the General Electric Co. Mr. Clement was first employed by the company in 1904 as a student engineer, but he returned to the University of Vermont, his alma mater, the following year as instructor in electrical

DISCONNECT SWITCHES



Hook Stick Operated

Simple to Install

for Industrial Applications

Economy and efficiency are two of the best reasons why you should investigate Southern States' Type PG Disconnect Switches. Original cost is low. Operators find that the PG Switch opens and closes smoothly and positively. Available in ratings of 5, 7.5 and 15 kv. and in 200, 400 and 600 Amp.

Bulletin 156 gives full details covering Southern States' Type PG Disconnect Switches. Write today for your copy.

Southern States Equipment Corporation

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★ Representatives In Principal Cities ★

STREAMLINE TREE TRIMMING!

with Bartlett No. 1—WE Combination Pruner & Saw (with Pike Pole)

	Length	Weight
No. 1-WE Pruner Head Section	30 in.	2¾ lbs.
No. 44-WE Saw Head Section	30 in.	1½ lbs.
Intermediate Extra Section	48 in.	1½ lbs.
Bottom Extra Section	48 in.	1¼ lbs.
No. 1-WE Pike Pole Attachment	8 in.	1½ lbs.
TOTAL WEIGHT		8½ lbs.

Three complete tools . . longest section 48 in. . .
EASILY CARRIED IN SMALL CAR OR MOTORCYCLE.

This combination can be quickly and easily assembled to make any of these three tools:

1 Heavy Duty Tree Trimmer (1¼" cap.)	10½ ft.
1 Fast-cutting Pole Saw	10½ ft.
1 Test Pile Pole	8½ ft.

If longer lengths are required, specify extra sections 6 or 8 ft. long, or additional 4 ft. sections to make the necessary length.

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DETROIT, MICHIGAN

"We shall win . . . or we shall die!"
General Douglas MacArthur

VICTORY IS A "MUST"

To paraphrase General MacArthur's fighting words—

We must win this war on every front, industrial as well as battle, if we are to survive.

In that spirit, the American Gas and Electric Company systems have made extraordinary efforts to supply electric service to war industries within the territory they serve.

The increased demands on our systems occasioned primarily by war industries have necessitated an enormous expansion of power generating and transmission facilities.

In 1918, at the peak of the first World War effort, *the territory now served by the American Gas and Electric Company systems contained 91 plants with a combined generating capacity of 373,000 kilowatts.*

The total generating capacity installed on the systems *since the beginning of World War II in September, 1939, and to be installed within the next year, is 491,500 kilowatts.*

With the installation of these extensions, all of which are now completed or under construction, the system capacity will be *1,828,000 kilowatts,* of which over *86 per cent* will be in *12 major plants. Approximately 5 times the entire system capacity as it existed in the last war!*

Our man power and facilities are dedicated to help in the production of implements of war that will bring VICTORY.

AMERICAN GAS AND ELECTRIC COMPANY

★ ★ ★

Principal Operating Affiliates

Appalachian Electric Power Company
Atlantic City Electric Company
Indiana & Michigan Electric Company
Indiana General Service Company
Kentucky and West Virginia Power Company
Kingsport Utilities, Incorporated
The Ohio Power Company
The Scranton Electric Company
Wheeling Electric Company

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SHELDON EV-R-ON

SOLDERLESS CABLE TERMINALS

"They are ever on"

The terminal with 101 uses for cable connections

- PREVENTS POWER INTERRUPTIONS
- CUTS INSTALLATION TIME & COSTS
- PERMANENT CABLE CONNECTIONS

A twist of the wrench, and Sheldon terminals are on for keeps! Eight sizes take cables from #8 solid to 1000 MCM. Your investment and inventory can be cut to a minimum. Dependability guaranteed through severest pull-out, mechanical distortion, heat-cycle and conductivity tests.

WRITE FOR LITERATURE

SHELDON

SERVICE CORPORATION

Long Island City, N. Y.

engineering. During the following years he was connected with J. G. White & Co. in New York and as valuation engineer with the New York State Public Service Commission. Mr. Clement's period of continuous service with G.E. dates from 1910, when he entered the lighting sales division. Later he was assigned to the syndicate department and subsequently to the sales division of the central station department.

▶ N. B. HINSON, chief engineer Southern California Edison Co., and HARVEY A. VAN NORMAN, general manager and chief engineer, Bureau of Waterworks and Supply, city of Los Angeles, have received honorary membership in the California Institute of Technology, Pasadena, Calif., chapter of Tau Beta Pi, national honorary engineering fraternity.

▶ ROSCOE E. IMHOFF has been appointed vice-president of Proctor Electric Co., Philadelphia. Mr. Imhoff has directed Proctor's sales activities for the past two years. He was with the Westinghouse Electric & Manufacturing Co. for 20 years before joining Proctor.

▶ P. Y. DANLEY has been appointed assistant sales manager of the Westinghouse merchandising division and H. F. HILDRETH as manager of commercial refrigeration and air conditioning sales. Both men will continue to make their headquarters in the Springfield, Mass., plant. Mr. Danley continues as head of war products of the merchandising division, a position he has held since 1941. He will direct merchandise sales activities carried on from the Springfield works. Before taking the war products assignment last year, Mr. Danley was manager of the Westinghouse air conditioning and commercial refrigeration sales at Springfield. Prior to that he was in Mansfield, first as assistant sales manager and later as manager of the refrigeration and air conditioning department. He has been associated with Westinghouse for 29 years. Mr. Hildreth has been sales development manager of the department he now heads since July, 1941. He joined Westinghouse in 1920 and engaged in central station engineering and sales work before entering the merchandising division in Mansfield in 1936. Two years later he went to Springfield.

OBITUARY

▶ DALE YINGLING, division engineer of the Southwestern Gas & Electric Co., in Texarkana, Ark., died suddenly on May 16, in his forty-third year. Mr. Yingling was in charge of construction

Insulation Tests Simplified!

No more tiresome cranking of a hand driven generator

NEW STANDCO

B-5 MEGOHMER

Ranges: 0-200 Megohms
0-2000 Ohms
0-300 & 0-600 Volts DC

Steady test voltage of 500 volts DC instantly available, at the touch of a push button. Direct readings of insulation resistance obtained on special color-graded scale without any calculations.

● Write for New BULLETIN 430

for details of design and operation of this radically new instrument.

HERMAN H. STICHT CO., INC.
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ELECTRICAL SPECIALTIES FOR HEAVY DUTY POWER SERVICE

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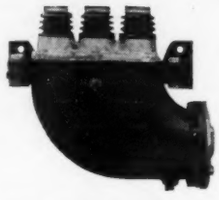

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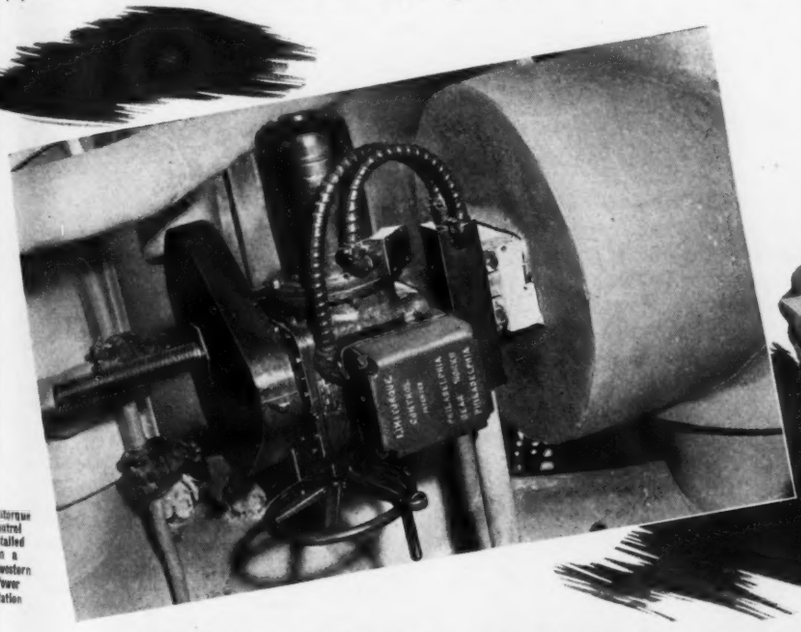
And that's a fact, . . . whether for emergency service or for normal plant operation Limitorque Valve Controls provide the sure means of opening or closing sluice gates or valves of all types from 3" to 96" diameter. They're convenient and time saving too, as they can be operated by responsible workman from a handy control station or central control panel.

Many of the country's largest and newest central stations, and industrial power plants equipped with Limitorque are daily proving this dependability.

For new constructions or the modernization of present plants Limitorque deserves investigation. These Controls are readily adaptable to existing equipment. Get all the details in our Catalog L. C.



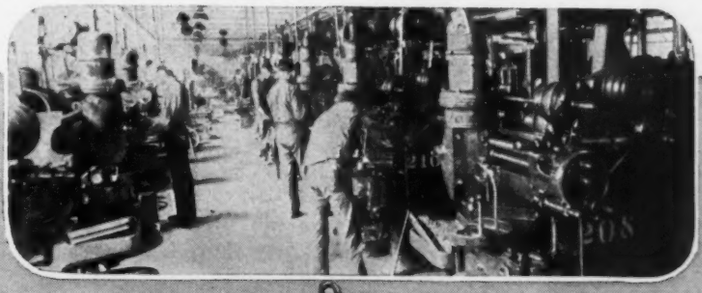
Limitorque Control installed in a Midwestern Power Station

PHILADELPHIA GEAR WORKS

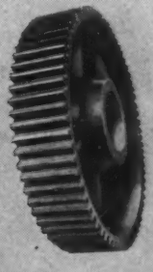
INDUSTRIAL GEARS AND SPEED REDUCERS LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET PHILADELPHIA, PA.

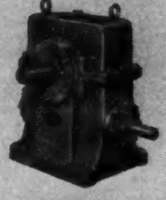
New York, Pittsburgh, Chicago



Philadelphia **LIMITORQUE CONTROL** operates all types of valves, etc., safely, economically, from convenient stations.

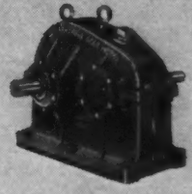


Philadelphia **GEARS** All types and sizes of industrial gears. Can be supplied in all materials.



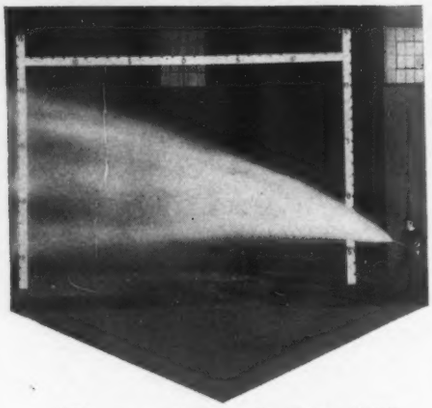
Philadelphia **WORM GEAR SPEED REDUCER** right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

Philadelphia **MOTOREDUCER** The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.



Philadelphia **HERRINGBONE SPEED REDUCER** for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

FIGHT Electrical Fires with Rockwood WaterFOG



This new Rockwood Type N-20 Nozzle has remarkable extinguishing action on fires in such electrical equipment as transformers, oil switches, generators, regulators, etc., and inflammable liquids.

The Rockwood N-20 WaterFOG Nozzle projects a larger WaterFOG pattern a greater distance by a new Rockwood method known as the *internal* impingement principle of generating and projecting WaterFOG. This simply designed nozzle converts plain water into a combination of *high* and *low* velocity WaterFOG, the new extinguishing agent which cools and smothers fire. The *low* velocity WaterFOG with its greater extinguishing action is projected farther by means of the proper amount of *high* velocity WaterFOG induced into the *low* velocity pattern. Thus, it is possible to project *low* velocity fog into the seat of a fire and extinguish it from distances not possible heretofore.

Rockwood N-20 WaterFOG Nozzle	
¾"	$15.00
1"	15.00
1½"	25.00
2½"	35.00

Fits existing fire hose lines

Electrical fires may be attacked and put out without danger of bringing the nozzle in contact with "live" electrical equipment. Extensive tests by a prominent engineering institute prove that Rockwood WaterFOG has a very low degree of conductivity making it safe to apply to electrical equipment carrying high voltages. Approved by Associated Factory Mutuals Laboratories for use around live electrical equipment and on flammable liquid fires.

Write for WaterFOG booklets.

No obligation.

Rockwood Sprinkler Company

62 Harlow Street, Worcester, Mass.

For 36 Years Specialists in the Engineering, Manufacture and Installation of Fire Protection Equipment

and maintenance of electrical distribution systems in the Texarkana area. He had been connected with the Southwestern utility for fifteen years.

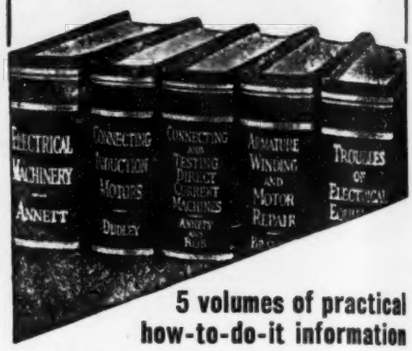
▶JOHN E. MCCARTER, engineer in charge of the power plant of the Wisconsin Michigan Power Co., Appleton, Wis., until his retirement three years ago, died on May 4, in his seventy-fourth year. Mr. McCarter had been associated with the utility company for 45 years.

▶ALAN T. CROWE, assistant sales manager of W. T. Henley's Telegraph Works Co., Ltd., Dorking, Surrey, England, died on April 22, at the age of 52. Before entering Henley's service Mr. Crowe had gained wide experience in the electrical industry, first in the workshops of Johnson & Phillips and later with the British Insulated Cables, Ltd., at Prescot. Mr. Crowe joined Henley's in 1912, and after the last war became chief assistant to the late Mr. Nichols, on whose death, nearly eight years ago, he assumed the title of assistant sales manager in charge of the sales engineering department.

▶CLAUDE C. SURBER, retired electric and gas utility executive, died on May 14 in Indianapolis, Ind., in his fifty-eighth year. Connected with various public utilities during his life, he at one time was owner and president of the Mid-States Utilities Co. in southern Indiana. Later he was vice-president and general manager of the Western Public Service Co. in Colorado Springs. In 1922 he went to Indianapolis to become manager of the securities department of the Merchants Heat & Light Co. and four years later was made treasurer of the Columbia Gas & Electric Co. in Cincinnati, Ohio. Two years later he returned to Indianapolis, where he had since lived.

▶E. G. S. PRYOR, Washington Surveying and Rating Bureau, and resident engineer for Underwriters' Laboratories, Inc., in Seattle, Wash., died on April 7, following an operation. Mr. Pryor worked at the Puget Sound Navy Yard and the Navy Yard in New York before entering Pratt Institute, from which he was graduated in 1921. He then entered the student test course of the Westinghouse Electric & Manufacturing Co., but left that organization in 1922 to join the New York staff of Underwriters' Laboratories. Shortly afterward he was assigned to the Bridgeport territory as inspector. In 1923 he was transferred to the Seattle office as resident engineer. Mr. Pryor was president of the northwestern section of the International Association of Electrical Inspectors 1936-37. He was recently elected chairman of the Puget Sound chapter.

Every phase of electrical maintenance and repair work covered in this Library



5 volumes of practical how-to-do-it information

Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

Electrical Maintenance and Repair Library

2042 pages, 1721 illustrations and diagrams

These books show you how to

—install all types of motor and generator units;
—locate breaks in armature windings and do a workmanlike job of rewinding;
—know just what is wrong with an electrical machine and take charge of installation and maintenance work;
—make accurate tests of switchboards and apparatus and correctly balance the power with the load;
—handle every sort of wiring job;
—show competence, whether it be in the use of a Stillson wrench of a Wheatstone bridge.

New trouble-shooting book

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a new book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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We want you to examine this Library for 10 days. If you don't want them at the end of that time, there's no obligation to keep them. On the other hand if you decide you want the help these books can give, start the small monthly payments then, and in a short time the books are yours, right while you have been using them. Send the coupon today.

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LETTER TO THE EDITOR

Area of Tubing in Circular Mils

To the Editor of ELECTRICAL WORLD:

Having recently been required to make quite a few calculations involving the current-carrying capacity of copper bus tubes, a simple method of determining the number of circular mils was evolved using only the O.D. and I.D. of the tube, in inches, without the bother of subtracting one area from another.

The calculation is based on the well-known algebraic factoring of $D^2 - d^2$ into $(D + d) \times (D - d)$.

A one-inch diameter rod has an area of 1,000,000 cir.mil, call it 1 MCM.

The area of any circular section in circular mils is diameter in inches squared, times one million.

Therefore, a two-inch diameter rod has an area of 4,000,000 cir.mil or 4 MCM.

A tube with a 2-inch outside diameter ($D = 2$) and a 1-inch inside diameter ($d = 1$) would therefore have an area of $4 - 1 = 3$ MCM. That is, $(D + d) \times (D - d) = (2 + 1) \times (2 - 1) = 3$.

This method may be new only to some and has probably been forgotten by old timers.

JOHN L. SKEEHAN,
American Bridge Company,
Ambridge, Pa.

•

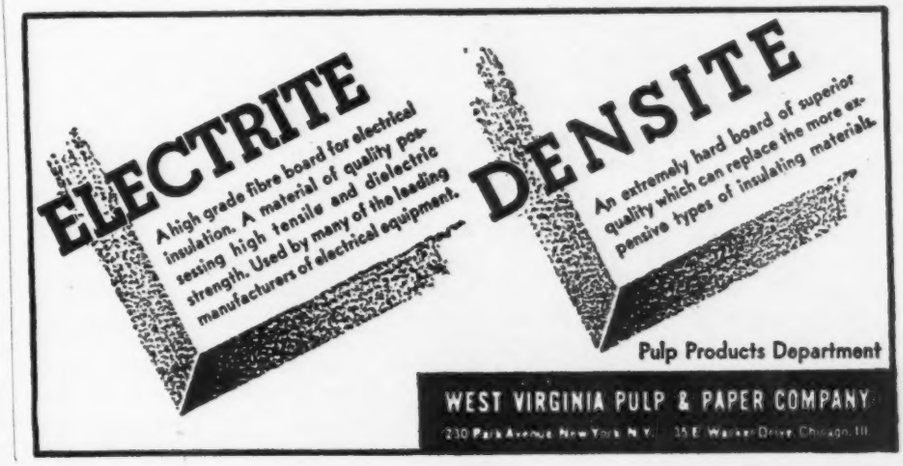
Furman Shoals Hearing Deferred by Board

Federal Power Commission has postponed from June 15 to August 3 a hearing on the Georgia Power Co.'s declaration of intention to complete construction of its Furman Shoals hydro-electric project, located on the Oconee River in Georgia.

Construction on the project was begun in 1929, Georgia Power stated, but abandoned in 1930 due to the depression. No permit was previously obtained because, at the time, counsel believed the project was located on a non-navigable stream. Recent court decisions, however, have laid down criteria for the determination of navigability considerably broader than obtained then.

Installed capacity of generating equipment for the new project would total 50,000 kva.

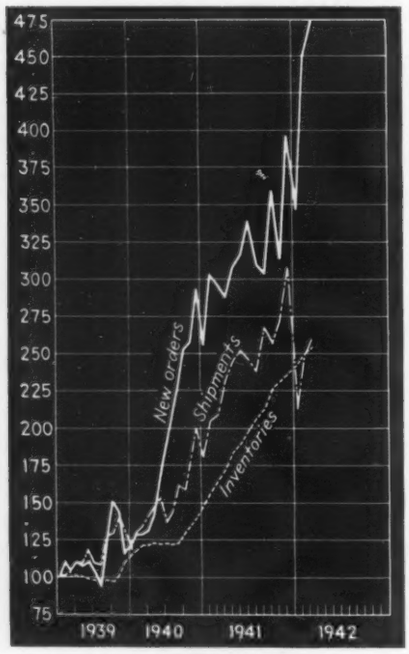
The Show Must Go On!
Unlike most industrial enterprises, gas and electric companies provide services for which the need is unceasing. Their plants, transmission and pipe lines must be built and maintained to meet peak demands at all times. Light, heat and power cannot be packaged or stored in warehouses, as is merchandise, awaiting sale. Every day new uses and new users are found.
Yet, despite enormous capital outlay thus required, these companies are constantly increasing facilities . . helping to decentralize industry and population . . gradually extending the benefits of modern living.
In the past decade, utilities have made great advances in efficiency and economy of production.
Exemplifying this progress are plants of larger capacity, with interconnections to stabilize their load, expand their radius and assure continuity of their service.
COLUMBIA SYSTEM
COLUMBIA GAS & ELECTRIC
CORPORATION


ELECTRITE
A high grade fibre board for electrical insulation. A material of quality possessing high tensile and dielectric strength. Used by many of the leading manufacturers of electrical equipment.
DENSITE
An extremely hard board of superior quality which can replace the more expensive types of insulating materials.
Pulp Products Department
WEST VIRGINIA PULP & PAPER COMPANY
230 Park Avenue New York N.Y. 35 E. Wacker Drive Chicago, Ill.

MANUFACTURING-MARKETS

Electric Machinery Indices Advance

Huge orders for war materials were again placed with manufacturers during the month of March, according to the survey of manufacturers' inventories, shipments and new orders made by the Bureau of Foreign and Domestic Commerce. Some idea of the large amount of new business placed during the month, the survey stated, can be gathered from the fact that orders for durables continued to outstrip the record-breaking volume of shipments to further increase the backlog of unfilled orders by 7 percent.



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

Orders for products of the electrical machinery industry continued to move upward from February totals—the index advancing to 474 from 452 in February. This compares with 296 for March, 1941.

Following the general trend of shipments of the durable goods industries, the value of electrical machinery shipments moved upward the index reaching 258, compared with 249 in February and 177 in March, 1941. The index of the value of electrical machinery inventories in March stood at 255.3, compared with 250.3 in February and 165.4 in March, 1941.

•

Handy & Harman Holds Anniversary Banquets

Handy & Harman celebrated its 75th anniversary at banquets attended by company officials and all employees in Bridgeport and New York on May 14 and 15. G. H. Niemeyer, president, presided at both and presented service awards to all who had been connected with the company for more than ten years. A testimonial was presented to Harry H. De Loss, former vice-president.

Of the 68 to receive awards at Bridgeport, fourteen, lead by R. H. Leach, vice-president, Bridgeport, were awarded gold watches in recognition of 25 years or more of service. In New York, Mr. Niemeyer and C. W. Handy, chairman, were among those to whom watches were awarded.

An anniversary booklet, telling some interesting facts about the company's history, facilities, products and the war work now in progress, has been prepared and will be distributed in the various trades served by the company.

•

Bendix Now 100% on War Work; Initial Dividend

Bendix Home Appliances, Inc., has voted an initial common share dividend of ten cents and another dividend of 45 cents a share on the Class A stock.

"Out of profits from automatic home laundry machines sales," said President J. S. Sayre, "directors declared an initial dividend of ten cents a share on the 762,640 common shares, thereby marking the close of the first chapter of our business. From September 30, 1937, when commercial shipments began, to May 7, 1942, when on War Production Board orders we shipped the last laundry machine for the duration, we made, shipped and, through dealers and distributors, sold 325,677 machines. . . ."

The company began its second chapter on May 8. "Our plant," continued Mr. Sayre, "has been converted 100 percent to war production. Facilities are being enlarged through the erection of additional buildings and the installation of new equipment. We expect to employ a larger force in working for victory than we did in peacetime operations. . . ."

•

Square D Leases Plant in New York from DPC

Square D Company has leased a building in New York State from the Defense Plant Corporation for the quantity production of high grade prism binoculars, F. W. Magin, president, has announced. The company will produce all parts of the binoculars itself. "At the request of the U. S. Navy, we are undertaking to change our manufacture of optical components from a craftsman to a straight-line production basis, in the same manner that we have already gone into quantity production on the Kollsman sensitive altimeter and other precision instruments," Mr. Magin stated.

Mr. Magin pointed out that he could not disclose the quantity or amount of the contract.

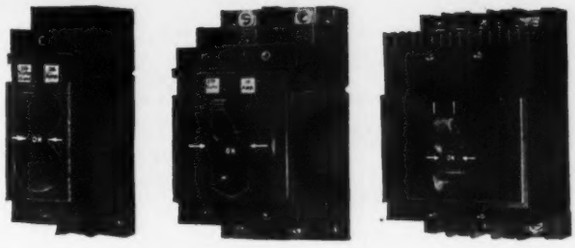
•

Navy "E"s Awarded

Award of "E" pennants for outstanding performance in production by industrial plants announced by the Navy include Anaconda Wire & Cable Co., Hastings-on-Hudson, N. Y., and General Electric plants at Schenectady, Philadelphia and Fort Wayne.

3 HEINEMANN "Re-Cirk-it" Fully Electro-Magnetic CIRCUIT BREAKERS

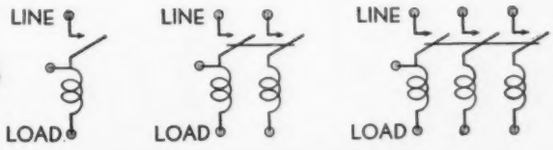
Single Pole | Two Pole | Three Pole



And

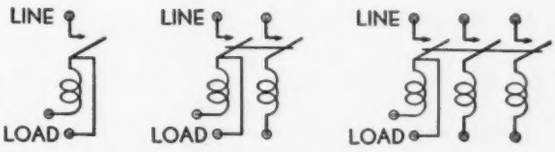
Here is what they do!

with CALIBRATING TAP



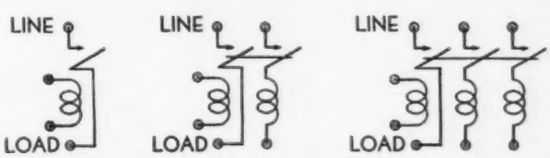
These "Re-Cirk-It" circuit breakers are assembled with an extra terminal attached to the load side of the interrupting mechanism which is the line side of the trip coil. This additional terminal can be used for an extra circuit not to have any effect on the trip coil; or it may be to provide means of connecting a rheostat or resistor in parallel with the trip coil to gain different fixed ratings; or an adjustable variation in the rating giving a much wider range in calibration of the tripping point.

with SHUNT TRIP



These "Re-Cirk-It" circuit breakers are assembled with the trip coil connected between an extra terminal and the load side of the interrupting means. The circuit connection from the line terminal through the contacts to the load terminal is solid without an overload coil, one end of the coil being connected to the load side of the contacts (interrupting means), the other end of the coil to the extra terminal. The use of this breaker is for remote control tripping so that a circuit of very low capacity at the same voltage may control the opening of the breaker.

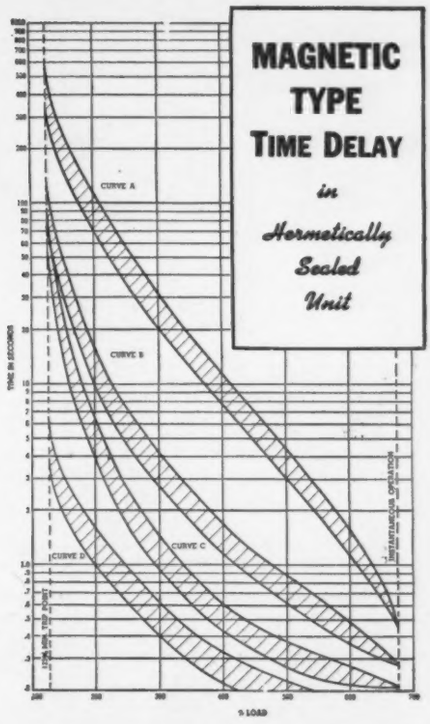
with RELAY TRIP



These "Re-Cirk-It" circuit breakers are assembled with the leads of the trip coil attached to separate terminals so that the interrupting mechanism (circuit opening means or contacts) may be in one circuit which is connected to the load and line terminals while the trip coil is connected to separate terminals and may be energized by a separate control circuit or may be used with the interrupting mechanism in the primary of a transformer and the coil in the secondary circuit. The trip coil can be arranged for as low as a few volts and up to several thousand.

TIME OVERLOAD CURVES

MAGNETIC TYPE TIME DELAY *in Hermetically Sealed Unit*



The time curves shown illustrate the wide range of adaptability of these breakers to various conditions. In other words, they can be assembled to meet specific requirements as to the time delay feature, since they are not dependent upon movement of thermostatic metal nor the heating of soft metal.

Curve "A" illustrates the standard time delay curve to which a standard time delay breaker will adhere. However, if so ordered, they may be had with other time curves. Curve "D," for instance, is the time curve of a breaker that would protect a load derived from gas filled lamps, and other circuits with similar characteristics, where the current returns to normal after about one cycle.

Curves "D" and "C" are also the ideal protection for small transformers since the breaker takes care of the relatively fast and high inrush of current during the first cycle when connected to the line.

If no time delay is desired, breakers can be had in instantaneous trip types. They will trip as soon as current rises to breaker rating.

Send for Catalog 40 with complete data.

HEINEMANN CIRCUIT BREAKER CO.,

SUBSIDIARY OF HEINEMANN ELECTRIC CO.

103 PLUM STREET *Established 1888* **TRENTON, N. J.**

THE NEW MODEL 520

INSULATION AND BREAKDOWN TESTER

Features a super-sensitive DANGER INDICATOR which AUTOMATICALLY GLOWS to indicate leakages up to 1,000 MEGOHMS

And supplies 4 voltages—250 VOLTS—500 VOLTS—1,000 VOLTS—2,500 VOLTS

ALSO INSTANTLY SHOWS UP "SHORTS" AND "OPENS"

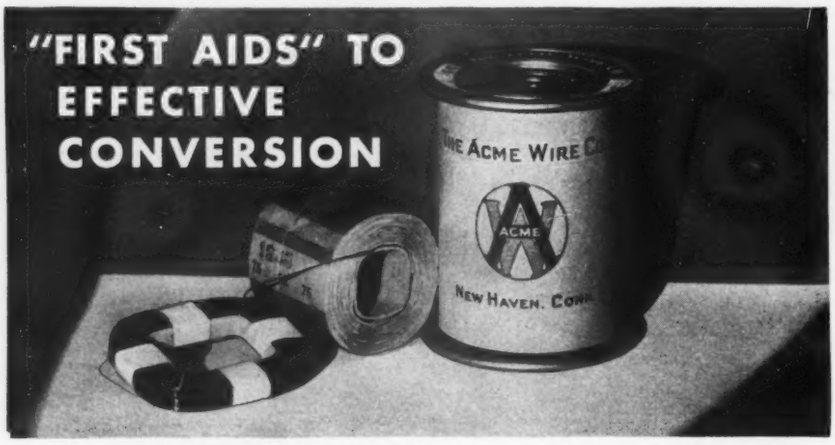
- NO HAND CRANKING
- NO BATTERIES TO REPLACE
- NO ADJUSTMENTS TO MAKE
- To use, simply connect the two test leads to the circuit, appliance or motor to be tested, then throw the switch. The Danger Indicator will automatically glow to indicate defective insulation, or insulation which, because of its excessive leakage, indicates a potential or imminent breakdown.

MAINTENANCE MEN—The MODEL 520 is designed for all-around plant and portable use. Compact and housed in a portable cabinet with special compartment for test leads, etc., this trouble shooter is a "must" instrument. Periodic checks of all electrical equipment with our instrument will enable you to prevent breakdowns and insure continuous operation of all equipment.

You can use the MODEL 520 to check between the sections of motors and generators for shorts and leakages. The 250 Volt range of the MODEL 520 is sensitive enough to indicate a leakage of 5 Megohms. If this leakage exists the motor or generator under test is unsafe and liable to short-circuit or burnout. The sensitivity of the MODEL 520 is 5 Megohms at 250 Volts, 25 Megohms at 500 Volts, 150 Megohms at 1,000 Volts and 1,000 Megohms at 2,500 Volts. Therefore, the High Range will show up a leakage which is safe and periodic checks with the MODEL 520 will enable you to detect progressively higher leakages.

The MODEL 520 operates on 90 to 125 Volts 60 cycles A.C. Size 6"x8"x4¾". Comes complete with portable cabinet, test leads and all necessary instructions. Only..... $14.85

SUPERIOR INSTRUMENTS CO. 227 FULTON ST., DEPT. EW NEW YORK, N. Y.



We are specialists in:

—design and manufacture of COILS wound with magnet wire,

—manufacture and use of MAGNET WIRE,

—any insulating problem,

We can help.

WE MANUFACTURE

MAGNET WIRE—Round, solid copper, insulated with enamel, Formvar, cotton, silk, Nylon, paper, Fiberglas or combinations of these.

COILS—wound with magnet wire to specification.

VARNISHED INSULATIONS—Cambrics, tapes, paper, silk, silk substitutes, Fiberglas.

ACME

Acme Wire PRODUCTS

The Acme Wire Co., New Haven, Conn.

Manufacturers Issue Earnings Reports

Rome Cable Corp. reports net profit for the year to March 31, after $170,000 reserve against future price decline in copper and for other contingencies, of $431,165, equal to $2.27 each on 189,830 shares, against net profit in preceding fiscal year of $385,460, or $2.03 a share, after $40,000 reserve against price decline in copper. Current assets on March 31 last amounted to $2,847,912 and current liabilities to $533,468.

EMERSON ELECTRIC MANUFACTURING—For four months ended January 31, profit $319,217 after expenses, etc., but before federal and state taxes on income.

REVERE COPPER & BRASS—Quarter ended March 31, net profit $995,658, after interest, depreciation, amortization of war facilities, provision of $3,950,000 for federal income and excess profits, taxes, etc. equal to $8.39 a share on combined 24,587 shares of 7 percent cumulative preferred and 94,118 shares of 5¼ percent cumulative preferred stocks. Allowing for only quarterly dividend requirements on the two preferred stocks, the balance of the March quarter earnings is equal to 64 cents a share on 1,286,916 shares of common stock outstanding at close of period. In like 1941 quarter, company and wholly owned subsidiaries, net profit $1,053,747 after provision of $2,150,000 for federal taxes on income. Based on presently outstanding preferred and common shares net was equal to 68 cents a common share.

ELECTRIC HOUSEHOLD UTILITIES—For 1941, net income $701,665, or $1.81 a share; for 1940, net income $247,321, or 64 cents a share.

•

Convert College Machine Shop to War Factory

Purdue University's student machine shops at Lafayette, Ind., customarily used only for routine practice work, recently have been converted into a war production factory under terms of a Westinghouse subcontract. R. A. McCarty, vice-president in charge of the subcontracting program of the Westinghouse Electric & Manufacturing Co., has announced.

More than 275 engineering students enrolled in the shop course are working part-time on the subcontract. Together their production is the equivalent of a 75-man machine shop working full time on war materials.

•

Issues Priority Booklet

Manning, Maxwell & Moore, Inc., Bridgeport, Conn., is distributing a new booklet entitled, "Priorities Mobilize Production for Victory." Published in an effort to assist jobbers, salesmen and customers, this sixteen-page booklet explains priorities and how to understand and use them.

Field Reports on Business

Markets are in process of adjustment to full war basis. Conversion of industrial plants to war production is now well advanced. The control of prices is already a fait accompli. Much electrical equipment is included in war orders and manufacturers of this type of equipment report heavy backlogs.

NEW YORK

Heavy unfilled orders of electrical equipment manufacturers have not been helped much by stoppage of electrical appliance production because the manufacturing facilities released are being converted, almost 100 percent, to war work. Inability of the companies to ship goods in sufficient volume to meet increasing demands is another contributing factor to unusual backlogs.

Retailers are perplexed about the price-fixing order, but, despite narrower operating margins, are looking forward to reasonably normal earnings because of savings in excess profits taxes. Sales, too, have shown few signs of slackening. The Federal Reserve Board's estimate of department store sales shows a 5 percent increase for the week ending May 16 over the corresponding week last year.

Utility financing becomes extremely active again with two large issues to be offered for competitive bidding within a week's time. These are Virginia Public Service's $36,500,000 refinancing and Public Service Electric & Gas's June 1 offer of $15,000,000 of 3 percent bonds.

Steel production capacity, blast furnace activity and sales of industrial electric power showed slight drops from the previous week.

Engineered construction volume for the week ended May 21 totalled $216,513,000, an increase of 315 percent over the corresponding week in 1941, but 6 percent under the figures for the previous week, according to *Engineering News-Record*. High totals for the first three weeks in May, however, insure a new record volume for the month.

NEW ENGLAND

New England's output of war material and equipment is growing fast, many cities in this highly industrialized section having from 75 to 100 percent of their factories engaged in this work. Government purchasing agencies are pressing for quick deliveries of much-needed equipment. Negotiated contracts for May are running ahead of April and about $2,000,000 in paper commitments were placed last week.

Construction awaits priority grants on the newly authorized $1,097,075, 23.5-mile tie line planned between the Somerset steam plant of the Montaup Electric Co. near Fall River, Mass., and the Cannon Street station of the New Bedford Gas & Edison Light Co. Terminal, overhead, cable and substation equipment will be required. An Army ordnance base is to be built in the Lowell, Mass., district. Montpelier, Vt., High School, will be equipped with 110 fluorescent lighting units by the Blanchard Electric Co. of that city.

Negotiations for electrical equipment to be used in new war plants now under construction are being pushed hard to insure delivery for plant operations in the fall. The demand for small motors, switches and panel boards is very active. Negotiated contracts closed recently cover coil-winding machines, terminals, antenna material, rubber products and large quantities of friction tape and ventilating equipment. Rohmer-Medford Wool Scouring Co. is operating a lately equipped plant with about 375 hp. in General Electric motor drives, largely individual units of Hunter Machine make. Domestic appliance sales feature socket type ovens and light equipment from dwindling stocks.

CHICAGO

The volume of sub-contracts in the Chicago area is rapidly approaching the $2,000,000,000 mark. Awarding of 52 additional war orders to 40 firms last week brought to 6,888 the total number of contracts placed with 1,483 companies in this area since the defense program began. Prime contracts awarded total $1,618,439,000 including $938,860,000 for manufactured products and $679,579,000 for construction of war plant facilities.

More appliance dealers are bowing to the inevitable and are arranging to discontinue business. Small contractors are feeling the pinch of restrictions on material for use in civilian properties and many are going into industrial plants or other lines. Department store sales in Chicago declined 14 percent from the previous week but remained 3 percent ahead of the comparable period last year.

Plomb Tool Co. is installing 44 motors totaling 196 h.p. and two 38 h.p. welders. Aetna Ball Bearing Co. will install 82 motors aggregating 432 h.p. The city electrical department has requested bids on 250 ornamental cast iron lamp posts. Westinghouse Electric & Manufacturing Co. received an order for switchgear equipment for $1,755.

PACIFIC COAST

Pacific Coast electrical firms, now busy overhauling price books to conform with government price-freezing regulations, are confronted with advances, mainly in conduits and roughing-in materials, caused by reversion, last fall, to all-rail prices. Efforts to establish chains of authorized repair stations for appliances have been hampered by lack of critical wire and other needed materials. Housing tops recent building awards, with two Seattle projects totaling $9,100,000 and covering 2,100 dwelling units; a $9,888,100 award to Vancouver, Wash., for 3,278 demountable units; 3,100 units planned in area adjacent to San Diego.

Industrial developments cover a $3,000,000 ship contract to Newport Beach, construction of a fourth shipyard at Richmond, and RFC assistance for Shell Chemical Co.'s Butadiene synthetic rubber plant near Compton, southern California, to cost $15,000,000. Electric wiring and distribution system for Tacoma aluminum plant will cost $364,220. General Electric at $216,487 was low bidder for carrier-current equipment for Bonneville-Coulee system. Varied purchasing covers $18,318 Westinghouse circuit breakers; $81,798 for six 4,000-kva. G.E. transformers, both for Bonneville; $30,880 for four 1,500-kva. Wagner transformers for Davis Dam; a 125-ton electric gantry crane costing $153,700 for Shasta Dam, and $15,052 Jeffery-Dewitt insulators for Parker Dam system in Arizona.

Matthews Stazrite Guards

shown above and below have no hardware on them. They are attached to the guy wire at the top and to one of the bolts of a three-bolt clamp at the bottom. They become a part of the guy fixture and can not vibrate loose, turn over or be made a greater hazard by "one-arm drivers." The upper photograph shows the 14-gauge half round and the lower photograph shows the 16-gauge full round types. Send for Bulletin C-2. Try them at our risk of your approval.

W. N. MATTHEWS CORPORATION

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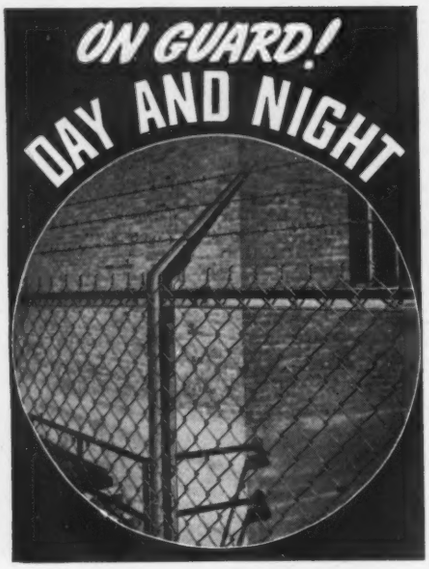

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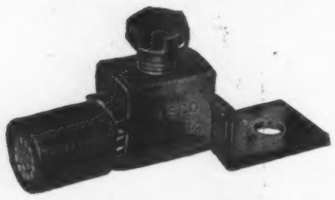

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ILSCO COPPER TUBE AND PRODUCTS, INC.
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Sales Opportunities

KANSAS CITY, MO.—Kansas City Power & Light Co., has approved plans for one-story addition, about 36 x 61 ft., to steam-electric power plant on Grand Avenue, for expansion in steam-generating department, and will begin superstructure soon. No estimate of cost announced.

INDIANA HARBOR, IND.—Inland Steel Co., 38 South Dearborn Street, Chicago, Ill., will begin erection soon on large power plant at blast furnace, Indiana Harbor works, where expansion is being carried out for production for government. Award for structural steel framing for power house, totaling 1,700 tons, has been made. No estimate of cost announced. Financing will be provided by Defense Plant Corporation, Washington, D. C., a federal agency. Arthur G. McKee & Co., 2300 Chester Avenue, Cleveland, Ohio, are consulting engineers.

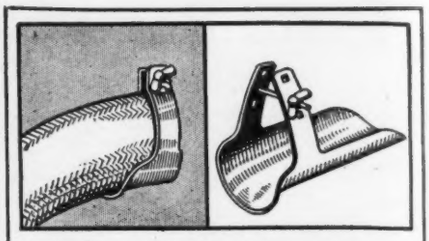
BAINBRIDGE, GA.—War Department, Constitution Avenue and Twentieth Street, N.W., Washington, D. C., has authorized new air force training school in vicinity of Bainbridge, consisting of a large group of one and multi-story buildings, with hangars, machine and mechanical shops, storage and general service structures, as well as dormitories, administration building, recreation center and miscellaneous buildings. A power substation is planned for central station power supply, with several smaller transformer stations, including electrical distribution system for light and power service. An airfield lighting system will be installed, with station control facilities. Motors and controls, switchgear, conveyors and other equipment will be installed in various shop buildings. Entire project will cost over $3,000,000, and will be carried out at early date under direction of United States Engineer Office, Mobile, Ala.

DODGEVILLE, WIS.—Wisconsin Power & Light Co., Madison, Wis., has approved plans for new power substation at Dodgeville, and will place work under way at once. Extensions will be made in transmission lines in that area, for connection with new station.

SOUTH BEND, IND.—Studebaker Corp., South Bend, manufacturer of automobiles, plans installation of motors and controls, transformers and accessories, switchgear, electric conduits, power wiring, fluorescent lighting system, electric hoists, conveyors and other equipment in new one-story addition for production of aircraft engines for government. Cost estimated close to $1,000,000. Work will be placed under way soon. Giffels & Vallet, Inc., and L. Rossetti, Marquette Building, Detroit, Mich., are architects and engineers. Financing for project will be provided by Defense Plant Corporation, Washington, D. C., a federal agency.

NAPOLEON, OHIO—Electric Light Department has made application for a priority rating for proposed expansion in municipal power plant, and will proceed with work as soon as this is granted. Capacity of station will be increased with installation of new turbine-generator unit and auxiliary equipment. Cost estimated close to $185,000.

FONTANA, CALIF.—Henry J. Kaiser Co., Inc., Latham Square Building, Oakland, Calif., has plans under way for new steam-electric power plant at blast furnace and steel mill to be constructed for production for government in vicinity of Fontana. Station is estimated to cost close to $2,000,000, with turbine units, high-



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pressure boilers, pumping machinery, air compressors and auxiliary equipment. Bechtel-McCone-Parsons Corp., 601 West Fifth Street, Los Angeles, Calif., is consulting engineer, and will be in charge of erection. Entire project will represent an investment of close to $40,000,000, with financing to be provided by Defense Plant Corporation, Washington, D. C., a federal agency. It is scheduled for completion in 1943.

WASHINGTON, D. C.—Contract and Service Officer, Civil Aeronautics Administration, Washington, receives bids until June 12 for 100 to 300 motor alternator sets (Circular 1471).

FORT PECK, MONT.—United States Engineer Office plans early installation of new 35,000-kw. electric generating unit in Fort Peck hydroelectric power station, for which authority recently has been granted. An additional fund of $1,300,000 is being secured for completion of hydroelectric generating station at dam, with work to be carried out this year.

PITTSBURGH, PA.—Carnegie-Illinois Steel Corp., Carnegie Building, Pittsburgh, plans installation of heavy-duty motors and controls, transformers and accessories, switchgear, regulators, electric conduits, power wiring, industrial lighting system, electric hoists, electric overhead traveling cranes and electric floor-operated cranes, conveyors and other equipment in connection with expansion in armor plate mill in Pittsburgh district for production for government. Several new units will be built. Entire project will cost close to $5,000,000. Work will be placed under way at once.

RICHMOND, IND.—Municipal Electric Lighting and Power Department plans new transmission line and power substation for connection with central station high-tension system. New facilities will be used for standby power service for municipality and are estimated to cost about $100,000. Project has been approved by City Council.

WILLARD, N. Y.—Navy Department, Constitution Avenue and Eighteenth Street, Washington, D. C., plans new naval training station on tract of about 2,500 acres of land on Seneca Lake, near Willard. It will comprise a large group of buildings for different branches of operation, including instruction units in electricity, signaling, radio, fire control and kindred work; also, laboratories for testing and other service, assembly halls, machine and mechanical shops, dormitories, recreation hall and miscellaneous structures. A power plant will be built with complete utilities for light and power service. Motors and controls, switchgear and other facilities will be installed in different shop and mechanical units. A radio broadcasting and receiving station will be built. Entire project is reported to cost over $20,000,000. Proposed to begin work at early date.

ESTILLINE, S. D.—Municipal Light and Power Department is considering extensions in municipal power plant, including installation of new generating unit and auxiliary equipment. Estimates of cost are being made.

LEBANON, MO.—Laclede Rural Electric Cooperative, Laclede, plans new power substation in connection with construction of about 25 miles of transmission and distributing lines. Also will build a one-story equipment storage unit in vicinity of new power substation. Financing has been arranged through federal aid and work will be placed under way soon.

Enrolled in a vital Service

While many of Asplundh's husky young tree experts have joined the colors, hundreds of our field force will stick with us until called. They realize that with more than half of America's plants engaged in defense work they are performing a vital service in keeping open power lines which carry the life-blood of industry . . . Don't let a power failure due to trees handicap our all-out production. This organization is equipped and ready to do an efficient and economical line clearing job on your properties . . . Write today for our several types of contracts.

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Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

Recent Rate Changes

ARKANSAS POWER & LIGHT CO. has been ordered by the state Utilities Commission to put into effect a new schedule of industrial rates, which will result in an annual saving of approximately $153,000. The new rates are to become effective June 1. New rates will mean an estimated annual reduction of approximately $37,000 in the power bills of cantonments and war industries, according to the commission. While the new schedules will result in an overall reduction in rates, some customers, who the commission stated "in comparison with others, have heretofore been receiving preferences," will find their rates increased. In such cases, the rates were held in abeyance pending further negotiation and adjustment. The increases are not to be applied without 90 days notice to the customer, but all such preferential rates must be adjusted before June 1, 1943. C. H. Moses, president of Arkansas Power & Light, said Arkansas' average rates were now lower than average charges in 25 cities in adjoining states, adding: "Industries already in the state will know about the low rates, but we intend to let industries in other sections know about them so they can give consideration to establishing any new plants in Arkansas . . . We will continue to seek to bring into the state industries that will add permanently to the state's wealth and payroll."

NORTHERN INDIANA PUBLIC SERVICE CO. has been ordered by the state Public Service Commission to reduce its electric rates in the Calumet section. The new rates affect the cities of Gary, Whiting, East Chicago and Hammond, all in Lake County. In an agreement with the Gary city council the company filed rates with the commission estimated to save consumers there $104,000 annually. The commission approved the schedule, effective May 1. But as it studied the agreement the commission decided on the same rates for other metropolitan areas in Lake County.

STATEN ISLAND EDISON CORP. has reduced its electric rates $100,000 annually, Milo R. Maltbie, chairman of the New York Public Service Commission, has announced.

BOSCOBEL (WIS.) municipal electric utility has filed with the state Public Service Commission a schedule of reduced rates which will save its customers $2,200 annually. The new rates for residential customers will include a 60-cent monthly fixed charge.

BLACK RIVER FALLS (WIS.) municipal electric utility has reduced its electric rates approximately $3,000 annually. More than 1,000 customers will benefit from the reduced charges, which became effective on May 1.

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REA Administration Funds Cut by Senate

The Senate reduced the administrative appropriation for Rural Electrification Administration by $250,000 in acting upon the annual Agriculture Department supply bill for the fiscal year beginning July 1. The reduction cuts REA's operating funds down to $3,500,000. The Senate made no change in the House-approved $10,000,000 loan limit for REA.

With Faith in The Future!

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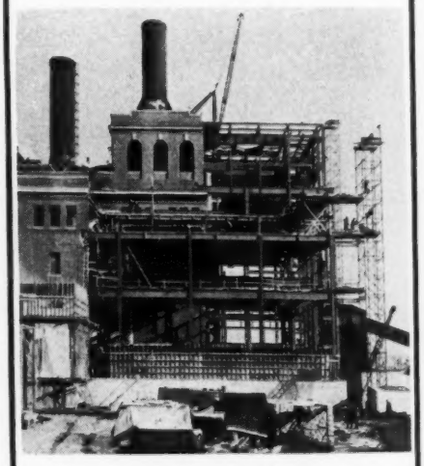

1942 Addition
South Meadow Station

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THE HARTFORD ELECTRIC LIGHT COMPANY

REA Allots Funds to 14 Systems

The Rural Electrification Administration recently announced allotments totaling $579,000 to 14 systems in eight states. One allotment includes funds for construction and revamping of a transmission line to serve an Army ammunition depot, and another will permit a cooperative to meet expanding power needs at a flying school operating as a contractor for the Army Air Corps. A South Carolina allotment will provide service to a defense housing area.

REA Administrator Harry Slattery said most of the allotments are to be used to complete service extensions to consumers living within 250 feet of existing distribution lines and systems requiring reimbursement for extra expenditures.

One system in Colorado and another in Wyoming received approval of loan applications for construction of new lines and acquisition of existing lines. In the case of such allotments, the funds allotted for new construction will not be used until the war is over.

REA allotments now total $446,621,244, of which $77,923,200 represents operations during the current fiscal year.

Details of allotments follow:

COLORADO—High Line Electric Assn., Holyoke, $125,000 for 141.5 miles of line, 439 members. This includes $26,108 for acquisition and rehabilitation of systems in Hayes Center and Max, Neb.

ILLINOIS—Farmers Mutual Electric Co., Geneseo, $6,000 to complete a section of the system.

MINNESOTA—To complete sections of systems: Minnesota Valley Cooperative Light & Power Assn., Montevideo, $20,000; Steele-Waseca Cooperative Electric, Owatonna, $35,000; Border Electric Cooperative, Inc., International Falls, $8,000; North Pine Electric Cooperative, Inc., Finlayson, $25,000; Consumers Delight Electric Cooperative, Inc., Federal Dam, $20,000.

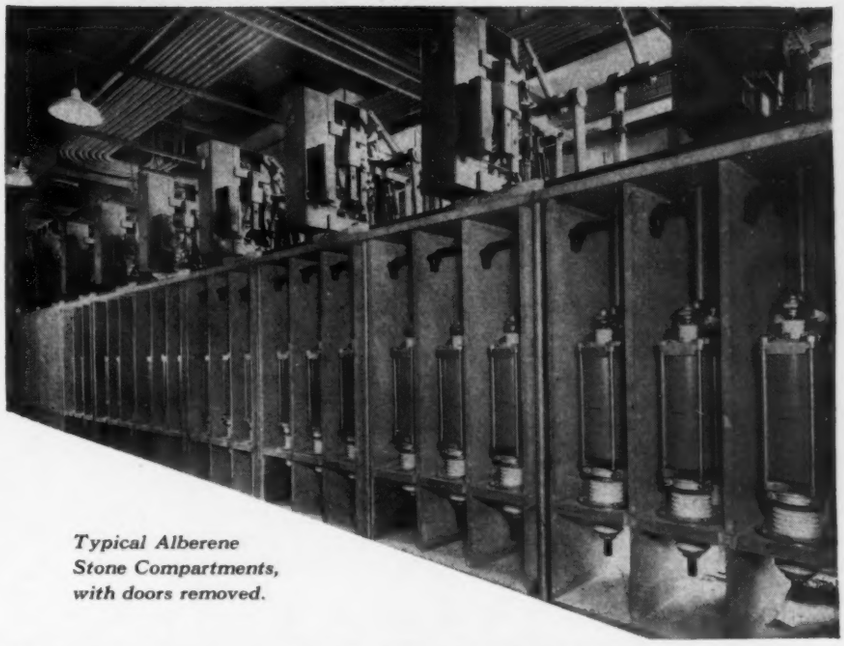
SOUTH CAROLINA—Berkeley Electric Cooperative, Inc., Moncks Corner, $17,000 to provide service for a military unit. Blue Ridge Electric Cooperative, Inc., Pickens, $40,000 to provide service to a housing area occupied by war production workers.

TEXAS—Dewitt County Electric Cooperative, Inc., Cuero, $35,000 to assist in providing service for a military unit.

VIRGINIA—Southside Electric Cooperative, Crewe, $40,000 to complete a section of the system. Accomack Northampton Electric Cooperative, Parksley, $20,000 to complete construction of generating plant.

WASHINGTON—Stevens County Electric Cooperative, Inc., Colville, $24,000 to complete a section of the system.

WYOMING—Wyrulec Company, Lingle, $164,000 for 237 miles of line, 513 members. This includes funds for acquisition and rehabilitation of transmission and distribution systems in Huntley, Hawk Springs and LaGrange.



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Immediate deliveries can be made for:

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For more than 40 years the electrical industry has known and used Alberene Stone. Easily cut and drilled, it can be used in relatively thin sections which save space and copper. Your inquiry will have immediate, executive attention. Alberene Stone Corporation of Virginia, 419—4th Ave., New York. Sales Offices in Principal Cities. Quarries and Mills at Schuyler, Va.

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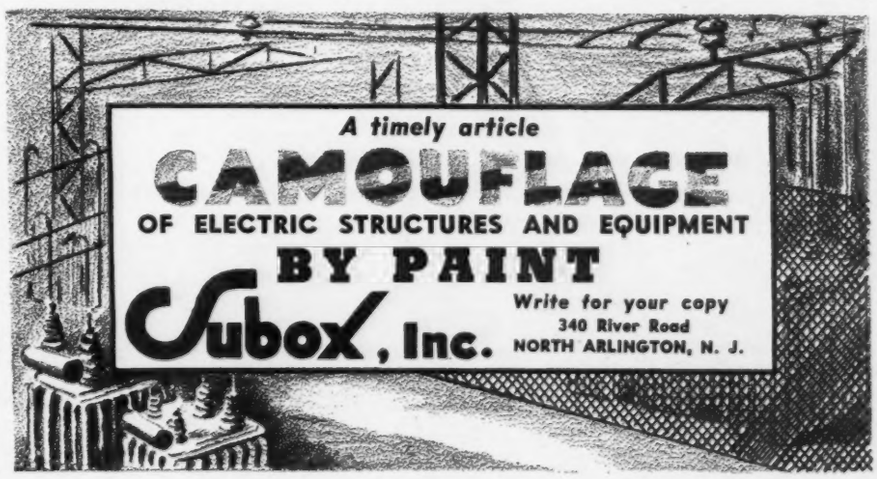

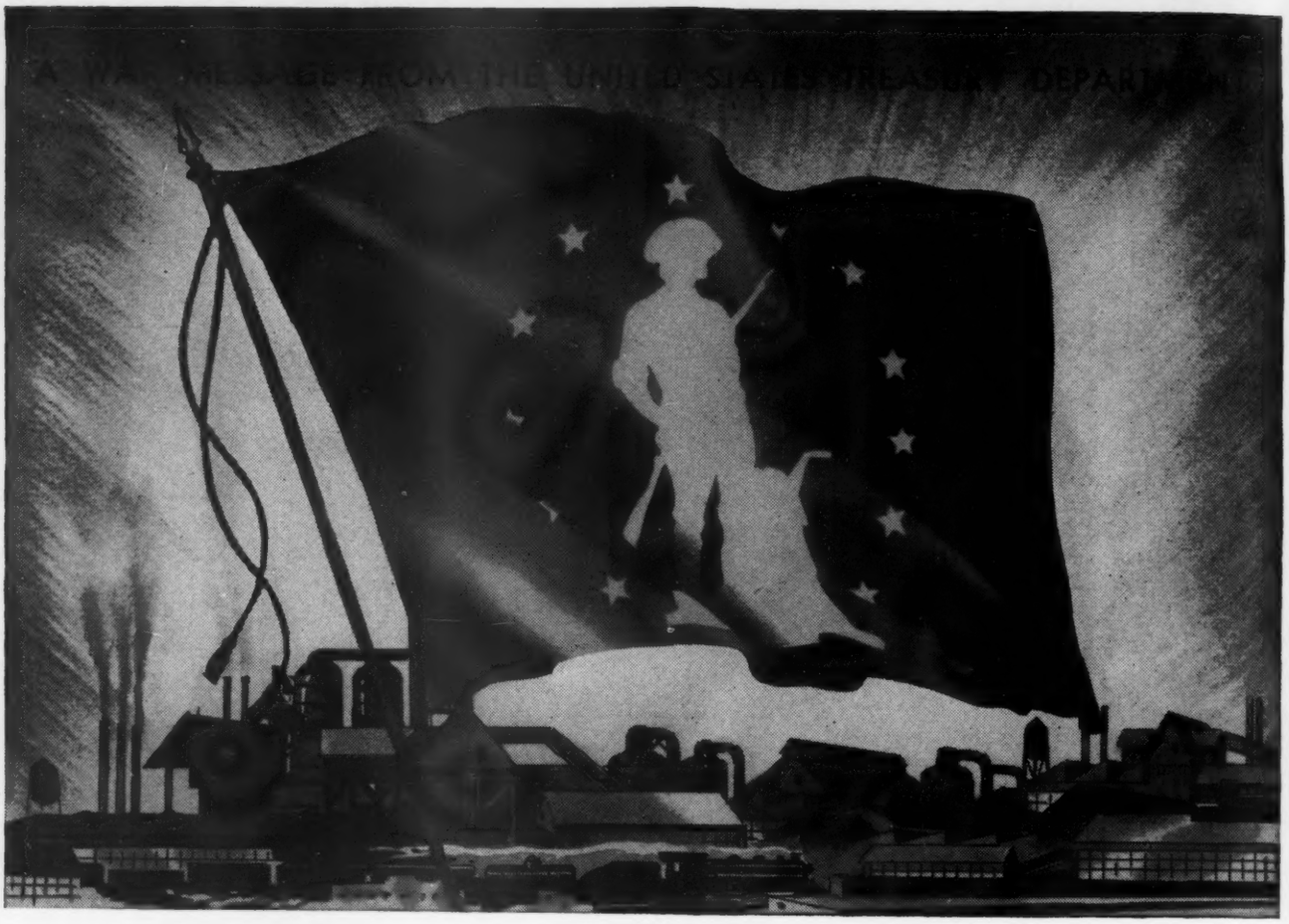

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Signifying 90 Percent or More Employee Participation in the Pay-Roll Savings Plan

IT doesn't go into the smoke of battle, but wherever you see this flag you know that it spells Victory for our boys on the fighting fronts. To everyone, it means that the firm which flies it has attained 90 percent or more employee participation in the Pay-Roll Savings Plan . . . that their employees are turning a part of their earnings into tanks and planes and guns *regularly,* every pay day, through the systematic purchase of U. S. War Bonds.

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If your firm has already installed the Pay-Roll Savings Plan, now is the time to increase your efforts: (1) To secure wider participation and reach the 90-percent goal; (2) to encourage employees to increase their allotments until 10 percent or more of your gross pay roll is subscribed for Bonds. "Token" allotments will not win this war any more than "token" resistance will keep our enemies from our shores, our homes. If your firm has yet to install the Plan, remember, TIME IS SHORT.

Write or wire for full facts and literature on installing your Pay-Roll Savings Plan now. Address Treasury Department, Section D, 709 12th St., NW., Washington, D. C.

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U. S. GOVERNMENT PRINTING OFFICE 16—27879-1 Form No. DSS-BP-1

Reading Increases First Step in Rate Schedule

Reading (Mass.) municipal light department has increased the first step of its residential and commercial rates in Reading by one cent per kilowatt-hour to meet the increasing costs of operation. The first 50 kw.-hr. per month are now being billed at 7 cents each. The existing 10 percent discount (on all except minimum bills) for prompt payment continues as before. This increase establishes uniform rates throughout the territory served by the department, including Lynnfield Center, North Reading and Wilmington.

The second block of 150-kw.-hr. continues as before for residences at 3 cents per kilowatt-hour, as does the final charge of 1.5 cents per kilowatt-hour for all energy consumed above 200 kw.-hr. per month. No serious complaint against the above increase has been received in the first month's operation under the schedule.

In 1941 the average energy consumption per residential meter was 1,040 kw.-hr., a gain of 26 kw.-hr. over 1940.

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Utility Again Thwarts Lebanon Acquisition

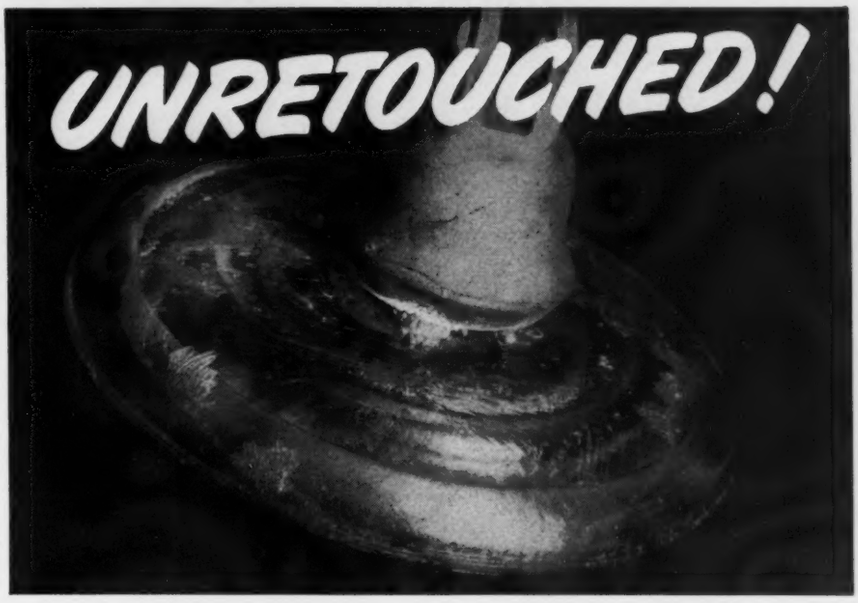
Moving to take over the electric distribution system of the Public Service Co. of Indiana, the city of Lebanon recently handed over a $210,000 check to the county clerk, but attorneys for the utility blocked the step by securing a temporary restraining order.

Condemnation proceedings first were brought by the city about five years ago, following a popular vote. An offer of $140,000 was refused and the city filed a court action. The lower court held the action unconstitutional, but the Indiana Supreme Court reversed the decision. Appraisers then fixed the valution at $210,000. The court litigation was carried to the Indiana Supreme Court three times and twice to the U. S. Supreme Court, with the utility losing all decisions eventually.

•

Utility Cited by FPC

Federal Power Commission has directed the Portland General Electric Co., Portland, Ore., to show cause at a public hearing to be held on June 15 in Portland why the commission should not order write-downs in the company's electric plant accounts totaling $12,866,482. The order provides that the Public Utilities Commissioner of Oregon and the Washington Department of Public Service may participate in the hearing.



WHAT would *your* insulators look like after 3700 amperes hit them? This unretouched photo shows a "Pyrex" suspension insulator after a 3700-ampere power arc was held directly on it by arc shields for one full second's duration!

What happened? As you can see from the candid photo . . . practically nothing! The only effect of this intense arc on the glass was a superficial crazing . . . the creation of a very thin layer of cracks on the surface. The body of the glass remained as sound as ever . . . and the "Pyrex" insulator could have gone right into service!

This is added proof that Pyrex brand Insulators maintain their efficiency under the toughest kind of operating conditions. Maximum performance and minimum maintenance cost are assured. And remember . . . you save on initial cost to boot!

BETTER PERFORMANCE . . . AT LOWER COST

SAVE ON INITIAL COST AND INSTALLATION

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